# EUTRA/LTE
# Digital Standard for R&S®SMW200A
# User Manual
# LTE closed-loop BS test, logfile generation, Rel. 9/Rel. 10

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Test & Measurement

User Manual

ROHDE&SCHWARZ

This document describes the following software options:

- R&S®SMW-K55/-K69/-K81/-K84/-K85
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The following abbreviations are used throughout this manual: R&S®SMW200A is abbreviated as R&S SMW, R&S®WinIQSIM2 is abbreviated as R&S WinIQSIM2

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# 1 Preface

## 1.1 Documentation Overview

The user documentation for the R&S SMW consists of the following parts:

- Getting Started printed manual
- Online Help system on the instrument
- Documentation CD-ROM with:
  - Getting Started
  - Online help system (`*.chm`) as a standalone help
  - User Manuals for base unit and options
  - Service manual
  - Data sheet and product brochure
  - Links to useful sites on the R&S internet

**Online Help**

The Online Help is embedded in the software. It offers quick, context-sensitive access to the complete information needed for operation and programming. The online help contains help on operating the R&S SMW and all available options.

**Getting Started**

This manual is delivered with the instrument in printed form and in PDF format on the documentation CD. It provides the information needed to set up and start working with the instrument. Basic operations and typical measurement examples are described. Safety information is also included.

**User Manual**

User manuals are provided for the base unit and each additional (software) option.

The user manual for the base unit is a supplement to the Getting Started manual and provides basic information on operating the R&S SMW in general. In this manual, all instrument functions are described in detail. Furthermore, it provides a complete description of the remote control commands with programming examples. An introduction to remote control is provided, as well as information on maintenance, instrument interfaces and troubleshooting.

In the user manuals for the individual software options, the specific instrument functions of this option are described in detail. For additional information on default settings and parameters, refer to the data sheets. Basic information on operating the R&S SMW is not included in these user manuals.

The user manuals are available in PDF format - in printable form - on the Documentation CD-ROM delivered with the instrument.

All user manuals are also available for download from the R&S website, on the R&S SMW product page at http://www.rohde-schwarz.com/product/SMW.html.

**Service Manual**

This manual is available in PDF format on the CD delivered with the instrument. It describes how to check compliance with rated specifications, instrument function, repair, troubleshooting and fault elimination. It contains all information required for repairing the R&S SMW by replacing modules.

**Release Notes**

The release notes describe the installation of the firmware, new and modified functions, eliminated problems, and last minute changes to the documentation. The corresponding firmware version is indicated on the title page of the release notes. The most recent release notes are available for download from the R&S website, on the R&S SMW product page at http://www.rohde-schwarz.com/product/SMW.html > Downloads > Firmware.

**Web Helps**

Web helps are provided for the base unit and each additional (software) option. The content of the web helps correspond to the user manuals for the latest product versions.

The web help is an additional file format that offers quick online access. The web helps are not intended for download but rather to access the required information directly form the R&S website.

Web helps are available at the R&S website, on the R&S SMW product page at http://www.rohde-schwarz.com/product/SMW.html > Download > Web Help.

## 1.2 Conventions Used in the Documentation

### 1.2.1 Typographical Conventions

The following text markers are used throughout this documentation:

| Convention | Description |
|---|---|
| "Graphical user interface elements" | All names of graphical user interface elements on the screen, such as dialog boxes, menus, options, buttons, and softkeys are enclosed by quotation marks. |
| KEYS | Key names are written in capital letters. |
| `File names, commands, program code` | File names, commands, coding samples and screen output are distinguished by their font. |
| *Input* | Input to be entered by the user is displayed in italics. |

| Convention | Description |
|---|---|
| Links | Links that you can click are displayed in blue font. |
| "References" | References to other parts of the documentation are enclosed by quotation marks. |

### 1.2.2 Conventions for Procedure Descriptions

When describing how to operate the instrument, several alternative methods may be available to perform the same task. In this case, the procedure using the touchscreen is described. Any elements that can be activated by touching can also be clicked using an additionally connected mouse. The alternative procedure using the keys on the instrument or the on-screen keyboard is only described if it deviates from the standard operating procedures.

The term "select" may refer to any of the described methods, i.e. using a finger on the touchscreen, a mouse pointer in the display, or a key on the instrument or on a keyboard.

# 2 Preamble

All supported features are in line with 3GPP Release 10, i.e. the following official 3GPP specifications are implemented:

- 3GPP TS 36.211, Version 10.6.0
- 3GPP TS 36.212, Version 10.7.0
- 3GPP TS 36.213, Version 10.8.0

# 3 Introduction

Currently, UMTS networks worldwide are being upgraded to high speed downlink packet access (HSDPA) in order to increase data rate and capacity for downlink packet data. In the next step, high speed uplink packet access (HSUPA) will boost uplink performance in UMTS networks. While HSDPA was introduced as a 3GPP Release 5 feature, HSUPA is an important feature of 3GPP Release 6. The combination of HSDPA and HSUPA is often referred to as HSPA.

However, even with the introduction of HSPA, the evolution of UMTS has not reached its end. HSPA+ will bring significant enhancements in 3GPP Release 7. The objective is to enhance the performance of HSPA-based radio networks in terms of spectrum efficiency, peak data rate and latency, and to exploit the full potential of WCDMA based 5 MHz operation. Important features of HSPA+ are downlink multiple input multiple output (MIMO), higher order modulation for uplink and downlink, improvements of layer 2 protocols, and continuous packet connectivity.

In order to ensure the competitiveness of UMTS for the next 10 years and beyond, concepts for UMTS long term evolution (LTE) have been investigated. The objective is a high-data-rate, low-latency and packet-optimized radio access technology. Therefore, a study item was launched in 3GPP Release 7 on evolved UMTS terrestrial radio access (EUTRA) and evolved UMTS terrestrial radio access network (EUTRAN). LTE/EUTRA will then form part of 3GPP Release 8 core specifications.

This introduction focuses on LTE/EUTRA technology. In the following, the terms LTE or EUTRA are used interchangeably.

In the context of the LTE study item, 3GPP work first focused on the definition requirements, e.g. targets for data rate, capacity, spectrum efficiency, and latency. Also commercial aspects such as costs for installing and operating the network were considered. Based on these requirements, technical concepts for the air interface transmission schemes and protocols were studied. Notably, LTE uses new multiple access schemes on the air interface: orthogonal frequency division multiple access (OFDMA) in downlink and single carrier frequency division multiple access (SC-FDMA) in uplink. Furthermore, MIMO antenna schemes form an essential part of LTE. In an attempt to simplify protocol architecture, LTE brings some major changes to the existing UMTS protocol concepts. Impact on the overall network architecture including the core network is being investigated in the context of 3GPP system architecture evolution (SAE).

## 3.1 Requirements for UMTS Long-Term Evolution

LTE is focusing on optimum support of packet switched (PS) services. Main requirements for the design of an LTE system are documented in 3GPP TR 25.913 [1] and can be summarized as follows:

- **Data Rate:** Peak data rates target 100 Mbps (downlink) and 50 Mbps (uplink) for 20 MHz spectrum allocation, assuming two receive antennas and one transmit antenna are at the terminal.

- **Throughput:** The target for downlink average user throughput per MHz is three to four times better than Release 6. The target for uplink average user throughput per MHz is two to three times better than Release 6.
- **Spectrum efficiency:** The downlink target is three to four times better than Release 6. The uplink target is two to three times better than Release 6.
- **Latency:** The one-way transit time between a packet being available at the IP layer in either the UE or radio access network and the availability of this packet at IP layer in the radio access network/UE shall be less than 5 ms. Also C-plane latency shall be reduced, e.g. to allow fast transition times of less than 100 ms from camped state to active state.
- **Bandwidth:** Scaleable bandwidths of 5 MHz, 10 MHz, 15 MHz, and 20 MHz shall be supported. Also bandwidths smaller than 5 MHz shall be supported for more flexibility.
- **Interworking:** Interworking with existing UTRAN/GERAN systems and non-3GPP systems shall be ensured. Multimode terminals shall support handover to and from UTRAN and GERAN as well as inter-RAT measurements. Interruption time for handover between EUTRAN and UTRAN/GERAN shall be less than 300 ms for realtime services and less than 500 ms for non-realtime services.
- **Multimedia broadcast multicast services (MBMS):** MBMS shall be further enhanced and is then referred to as E-MBMS.
- **Costs:** Reduced CAPEX and OPEX including backhaul shall be achieved. Costeffective migration from Release 6 UTRA radio interface and architecture shall be possible. Reasonable system and terminal complexity, cost, and power consumption shall be ensured. All the interfaces specified shall be open for multivendor equipment interoperability.
- **Mobility:** The system should be optimized for low mobile speed (0 to 15 km/h), but higher mobile speeds shall be supported as well, including high speed train environment as a special case.
- **Spectrum allocation:** Operation in paired (frequency division duplex / FDD mode) and unpaired spectrum (time division duplex / TDD mode) is possible.
- **Co-existence:** Co-existence in the same geographical area and co-location with GERAN/UTRAN shall be ensured. Also, co-existence between operators in adjacent bands as well as cross-border co-existence is a requirement.
- **Quality of Service:** End-to-end quality of service (QoS) shall be supported. VoIP should be supported with at least as good radio and backhaul efficiency and latency as voice traffic over the UMTS circuit switched networks.
- **Network synchronization:** Time synchronization of different network sites shall not be mandated.

## 3.2 LTE Downlink Transmission Scheme

The downlink transmission scheme for E-UTRA FDD and TDD modes is based on conventional OFDM. In an OFDM system, the available spectrum is divided into multiple carriers, called subcarriers, which are orthogonal to each other. Each of these subcarriers is independently modulated by a low rate data stream.

OFDM is used as well in WLAN, WiMAX and broadcast technologies like DVB. OFDM has several benefits including its robustness against multipath fading and its efficient receiver architecture.

The following figure 3-1 shows a representation of an OFDM signal (3GPP TR 25.892 [2]). In this figure, a signal with 5 MHz bandwidth is shown, but the principle is of course the same for the other E-UTRA bandwidths. Data symbols are independently modulated and transmitted over a high number of closely spaced orthogonal subcarriers. In E-UTRA, downlink modulation schemes QPSK, 16QAM, and 64QAM are available.

In the time domain, a guard interval may be added to each symbol to combat inter-OFDM-symbol-interference due to channel delay spread. In E-UTRA, the guard interval is a cyclic prefix which is inserted prior to each OFDM symbol.

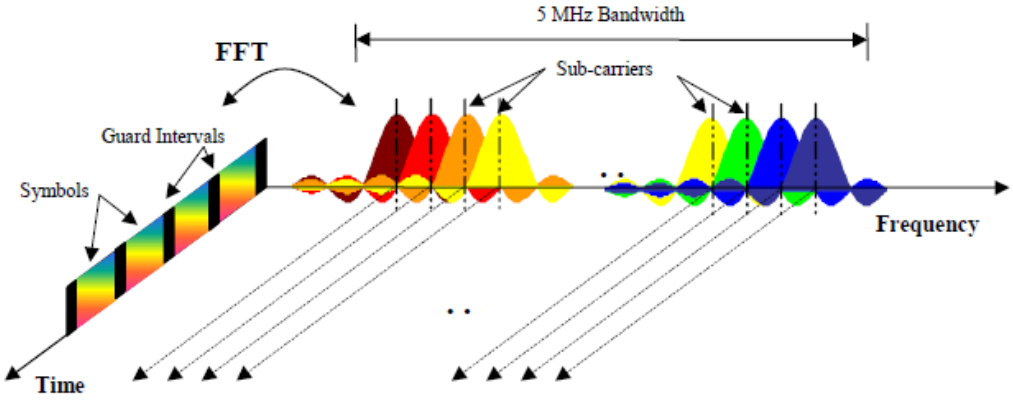



*Fig. 3-1: Frequency-Time Representation of an OFDM Signal (3GPP TR 25.892 [2])*

In practice, the OFDM signal can be generated using the inverse fast Fourier transform (IFFT) digital signal processing, as described in 3GPP TS 25.892, Feasibility Study for Orthogonal Frequency Division Multiplexing (OFDM) for UTRAN enhancement (Release 6). The IFFT converts a number N of complex data symbols used as frequency domain bins into the time domain signal. Such an N-point IFFT is illustrated in figure 3-2, where a(mN+n) refers to the $n^{th}$ subchannel modulated data symbol, during the time period $mT_u < t \leq (m+1)T_u$.

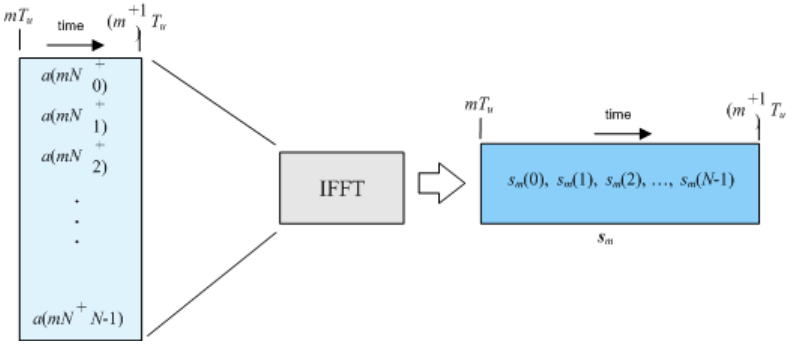



*Fig. 3-2: OFDM useful symbol generation using an IFFT (3GPP TR 25.892 [2])*

The vector $s_m$ is defined as the useful OFDM symbol. It is the time superposition of the N narrowband modulated subcarriers. Therefore, from a parallel stream of N sources of

data, each one independently modulated, a waveform composed of N orthogonal sub-carriers is obtained, with each subcarrier having the shape of a frequency sinc function (see figure 3-1).

The figure 3-3 illustrates the mapping from a serial stream of QAM symbols to N parallel streams, used as frequency domain bins for the IFFT. The N-point time domain blocks obtained from the IFFT are then serialized to create a time domain signal. Not shown in the figure is the process of cyclic prefix insertion.

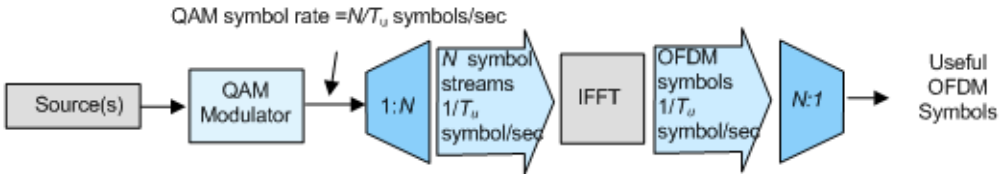



*Fig. 3-3: OFDM Signal Generation Chain (3GPP TR 25.892 [2])*

In contrast to an OFDM transmission scheme, OFDMA allows the access of multiple users on the available bandwidth. Each user is assigned a specific time-frequency resource. As a fundamental principle of E-UTRA, the data channels are shared channels, i.e. for each transmission time interval of 1 ms, a new scheduling decision is taken regarding which users are assigned to which time/frequency resources during this transmission time interval.

## 3.2.1 OFDMA Parameterization

Two radio frame structures, one for FDD (frame structure type 1) and one for TDD (frame structure type 2) mode are defined. These EUTRA frame structures are described in 3GPP TS 36.211 [3].

### 3.2.1.1 Frame structure type 1 (FDD)

The FDD frame structures type 1 is based on a 10 ms radio frame that is divided into 20 equally sized slots of 0.5 ms. A subframe consists of two consecutive slots, so one radio frame contains 10 subframes.

The figure below illustrates frame structure type 1 (Ts is expressing the basic time unit corresponding to 30.72 MHz). Frame format 1 is applicable to both full and half duplex FDD.

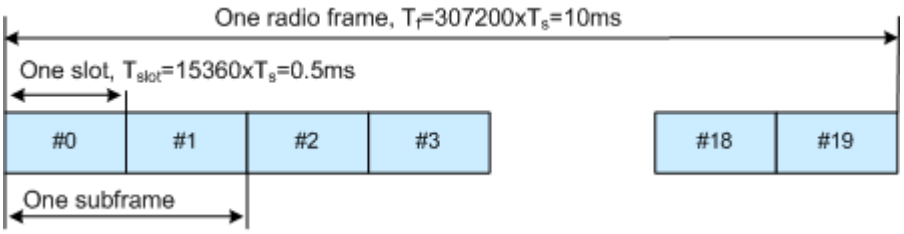



*Fig. 3-4: Frame format 1 (FDD mode)*

For information on the related settings, refer to"Duplexing" on page 78 , chapter 7.11, "DL Frame Configuration Settings", on page 146 and chapter 7.11.4, "OFDMA Time-plan", on page 152.

### 3.2.1.2 Frame structure type 2 (TDD)

The TDD frame format 2 is also based on a 10 ms radio frame, but the frame is divided into two half-frames, 5 ms each. Each half-frame consists of five 1 ms long subframes, which are reserved either for downlink or uplink transmission or are caring special information (see figure below).

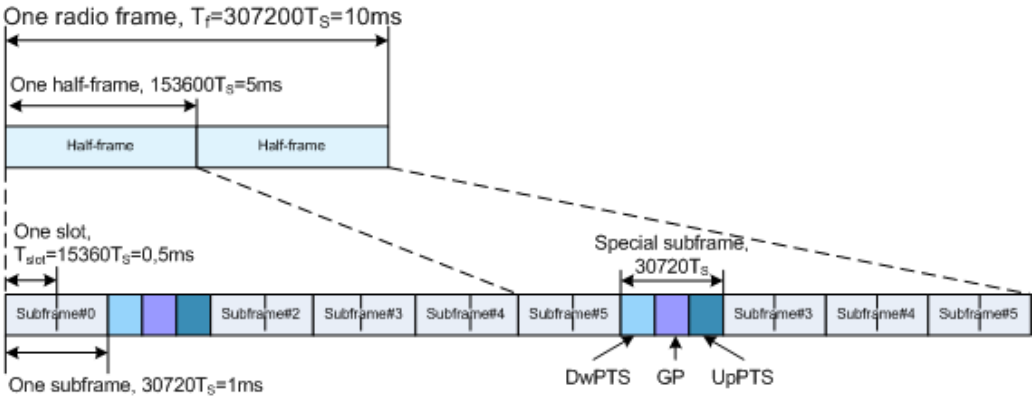



*Fig. 3-5: Frame format 2 (TDD mode), 5 ms switching periodicity*

All non-special subframes are divided into two 0.5 ms long slots. The special subframes consist of three fields DwPTS (Downlink Pilot Timeslot), GP (Guard Period) and UpPTS (Uplink Pilot Timeslot) which length can vary in specified limits so that the total special subframe's length is maintained constant (1 ms). The 3GPP specification defines nine special subframe configurations per cyclic prefix type that specified the allowed DwPTS/GP/UpPTS lengths' combinations.

The 3GPP specification defines seven different uplink-downlink configurations, i.e. defines the downlink-to-uplink switch-point periodicity (5 ms or 10 ms) and the allowed combination of downlink, uplink and special slots. In all the uplink-downlink configurations and for any downlink-to-uplink switch-point periodicity, subframe 0, subframe 5 and DwPTS are always reserved for downlink transmission and UpPTS and the subframe following the special subframe are always reserved for uplink transmission.

The table below shows the supported uplink-downlink configurations according to TS 36.211 [3], where "D" denotes a subframe reserved for downlink transmission, "U" denotes a subframe reserved for uplink transmission, and "S" denotes the special subframe.

| UL/DL Configuration | Downlink-to-Uplink Switch-point periodicity | Subframe number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 0 | 5 ms | D | S | U | U | U | D | S | U | U | U |
| 1 | 5 ms | D | S | U | U | D | D | S | U | U | D |
| 2 | 5 ms | D | S | U | D | D | D | S | U | D | D |
| 3 | 10 ms | D | S | U | U | U | D | D | D | D | D |
| 4 | 10 ms | D | S | U | U | D | D | D | D | D | D |
| 5 | 10 ms | D | S | U | D | D | D | D | D | D | D |
| 6 | 5 ms | D | S | U | U | U | D | S | U | U | D |

***Fig. 3-6: Uplink-downlink configurations***

For information on the related settings, refer to "Duplexing" on page 78, chapter 7.10.6, "TDD Frame Structure Settings", on page 135 and chapter 7.19, "TDD Timeplan", on page 260.

## 3.2.2 Downlink Resource Grid

The figure 3-7 shows the structure of the downlink resource grid for the duration of one downlink slot. The available downlink bandwidth consists of $N_{BW}^{DL}$ subcarriers with a spacing of Δf = 15 kHz. In the case of multi-cell MBMS transmission, a subcarrier spacing of Δf = 7.5 kHz is also possible. $N_{BW}^{DL}$ can vary in order to allow for scalable bandwidth operation up to 20 MHz. Initially, the bandwidths for LTE were explicitly defined within layer 1 specifications. Later on a bandwidth agnostic layer 1 was introduced, with $N_{BW}^{DL}$ for the different bandwidths to be specified by 3GPP RAN4 to meet performance requirements, e.g. for out-of-band emission requirements and regulatory emission limits.

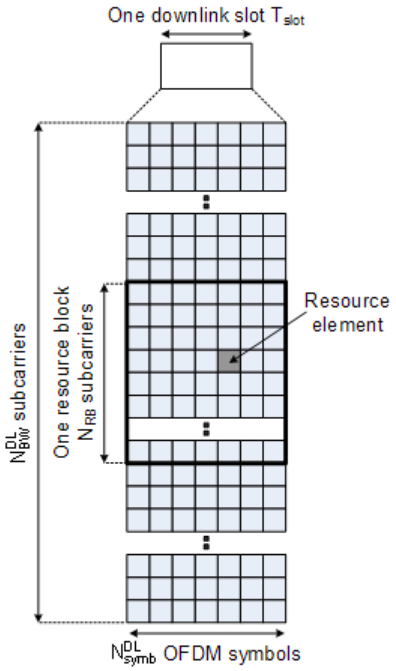



***Fig. 3-7: Downlink Resource Grid (3GPP TS 36.211 [3])***

One downlink slot consists of $N^{DL}_{symb}$ OFDM symbols. To each symbol, a cyclic prefix (CP) is appended as guard time, compare figure 3-1. $N^{DL}_{symb}$ depends on the cyclic prefix length. The generic frame structure with normal cyclic prefix length contains $N^{DL}_{symb}$ = 7 symbols. This translates into a cyclic prefix length of $T_{CP}$≈5.2µs for the first symbol and $T_{CP}$≈4.7µs for the remaining 6 symbols. Additionally, an extended cyclic prefix is defined in order to cover large cell scenarios with higher delay spread and MBMS transmission. The generic frame structure with extended cyclic prefix of $T_{CP-E}$≈16.7µs contains $N^{DL}_{symb}$ = 6 OFDM symbols (subcarrier spacing 15 kHz). The generic frame structure with extended cyclic prefix of $T_{CP-E}$≈33.3µs contains $N^{DL}_{symb}$ = 3 symbols (subcarrier spacing 7.5 kHz). The table 3-1 gives an overview of the different parameters for the generic frame structure.

***Table 3-1: Parameters for Downlink Generic Frame Structure***

| Configuration | Number of symbols $N^{UL}_{symb}$ | Cyclic Prefix length, samples | Cyclic Prefix length, us |
|---|---|---|---|
| Normal cyclic prefix<br>Δf=15 kHz | 7 | 160 for first symbol<br>144 for other symbols | 5.2 us for first symbol<br>4.7 us for other symbols |
| Extended cyclic prefix<br>Δf=15 kHz | 6 | 512 | 16.7 us |
| Extended cyclic prefix<br>Δf=7.5 kHz | 3 | 1024 | 33.3 us |

For information on the related settings, refer to chapter 7.11.4, "OFDMA Timeplan", on page 152 and chapter 7.19, "TDD Timeplan", on page 260.

### 3.2.3 Downlink Data Transmission

Data is allocated to the UEs in terms of resource blocks. A physical resource block consists of 12 (24) consecutive subcarriers in the frequency domain for the Δf=15 kHz (Δf=7.5 kHz) case. In the time domain, a physical resource block consists of DL $N_{symb}$ consecutive OFDM symbols, see figure 3-7. $N^{DL}_{symb}$ is equal to the number of OFDM symbols in a slot. The resource block size is the same for all bandwidths, therefore the number of available physical resource blocks depends on the bandwidth. Depending on the required data rate, each UE can be assigned one or more resource blocks in each transmission time interval of 1 ms. The scheduling decision is done in the base station (eNodeB). The user data is carried on the physical downlink shared channel (PDSCH).

For information on the related settings, refer to chapter 7.12, "Enhanced PBCH, PDSCH and PMCH Settings", on page 188.

### 3.2.4 Downlink Control Information Transmission

Control Information is mapped to the resource elements in terms of resource elements groups (REG). A REG consists of four consequent resource elements within one resource block which are not used for cell-specific reference signals. Thus, there are two types of resource blocks, resource blocks containing three REGs and resource blocks containing only two REGs.

Two REGs are available within the OFDM symbols with allocated reference signals, i.e. the OFDM symbol 0 in the first slot in a subframe, as well as in the OFDM symbol 1 in case of four-antenna system. Three REGs are then available in the OFDM symbols 2, as well as in the OFDM symbol 1 in case of one- or two-antenna system (see figure 3-8 and figure 3-9).

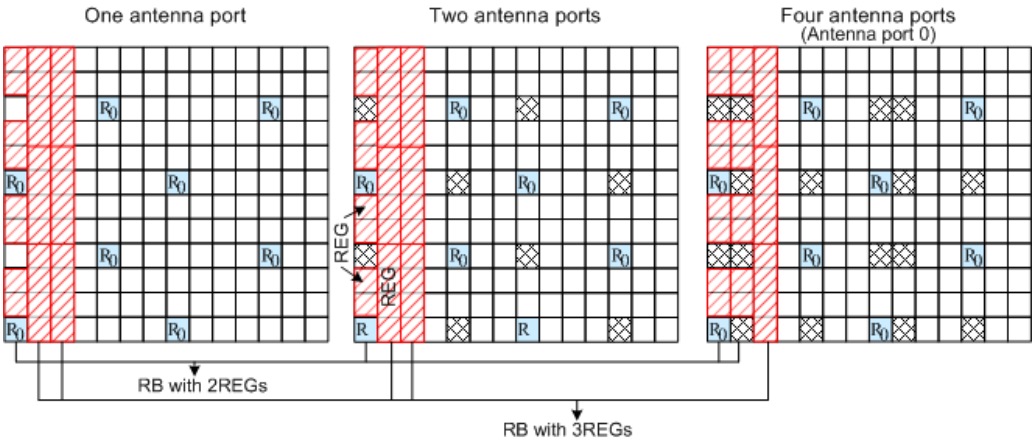



***Fig. 3-8: Resource elements groups (REG)***

Three physical DL channels are carrying the control information: the Physical Control Format Indicator Channel (PCFICH), the Physical Hybrid ARQ Indicator Channel (PHICH) and the Physical Downlink Control Channel (PDCCH).

- The **PCFICH** carries the information about the number of OFDM Symbols used for transmission of PDCCH in a subframe and is mapped to four REGs within the first OFDM Symbol.
- The **PHICH** carries the HARQ ACK/NACK messages and is transmitted in terms of PHICH groups. A PHICH group uses three REGs. For normal CP, a PHICH group consists of up to eight ACK/NACK messages. Four ACK/NACK messages are carried by one PHICH group if an extended CP is used.
  For frame format 1 and non-MBSFN transmission, the PHICH can be transmitted over only the first OFDM symbol (this is the so called normal PHICH duration) or in case of extended PHICH duration, over the first three OFDM symbols.
- Downlink control signaling on the Physical Downlink Control Channel (**PDCCH**) is used to convey the scheduling decisions to individual UEs. The PDCCH is located in the first OFDM symbols of a slot.
  The maximum number of OFDM symbols used for the transmission of a PDCCH is determined by the number of RB used, i.e. for channel bandwidth with less than or equal to 10 RBs, four OFDM symbols are necessary (OFDM symbol 0...3) and respectively for channel bandwidths greater than 10 RBs three OFDM symbols are sufficient (OFDM symbol 0...2).
  The minimum number of OFDM symbols used for the transmission of a PDCCH is determined by the PHICH duration and the channel bandwidth.
  The PDCCH is mapped to the REGs not used for PHICH and PCFICH and transmitted on one or several control channel elements (CCEs), where a CCE corresponds to 9 REGs.

For information on the related settings, refer to "PHICH Duration" on page 134 .

### 3.2.5 Downlink Reference Signal Structure and Cell Search

The downlink reference signal structure is important for cell search, channel estimation and neighbor cell monitoring.

For the LTE downlink, four types of reference signals are defined:

- Cell-specific downlink reference signals
  The cell-specific reference signal are common signals in a cell, that are intended for all UE within this cell.
- chapter 3.2.5.2, "MBSFN reference signals", on page 25
  These reference signals are used for channel estimation and demodulation of signals transmitted by means of MBSFN.
- UE-specific reference signal (DM-RS)
  These reference signals are intended for a specific user.
- chapter 3.2.5.4, "Positioning reference signals", on page 27
- chapter 3.2.5.5, "CSI reference signals", on page 28
  These reference signals are intended channel quality measurements and frequency deppendent scheduling.

For information on the related settings, refer to:

- chapter 7.10.7.1, "Downlink Reference Signal Structure", on page 136
- chapter 7.10.8, "Positioning Reference Signal (PRS) Settings", on page 137
- chapter 7.10.9, "CSI Settings", on page 140.

#### 3.2.5.1 Cell-specific downlink reference signals

The figure 3-9 shows the principle of the downlink reference signal structure for one-antenna, two-antenna, and four-antenna transmission (antenna ports 0 .. 3). Specific predefined resource elements in the time-frequency domain carry the reference signal sequence. Besides first reference symbols, there may be a need for second reference symbols. The different colors in the figure represent the sequences transmitted from up to four transmit antennas.

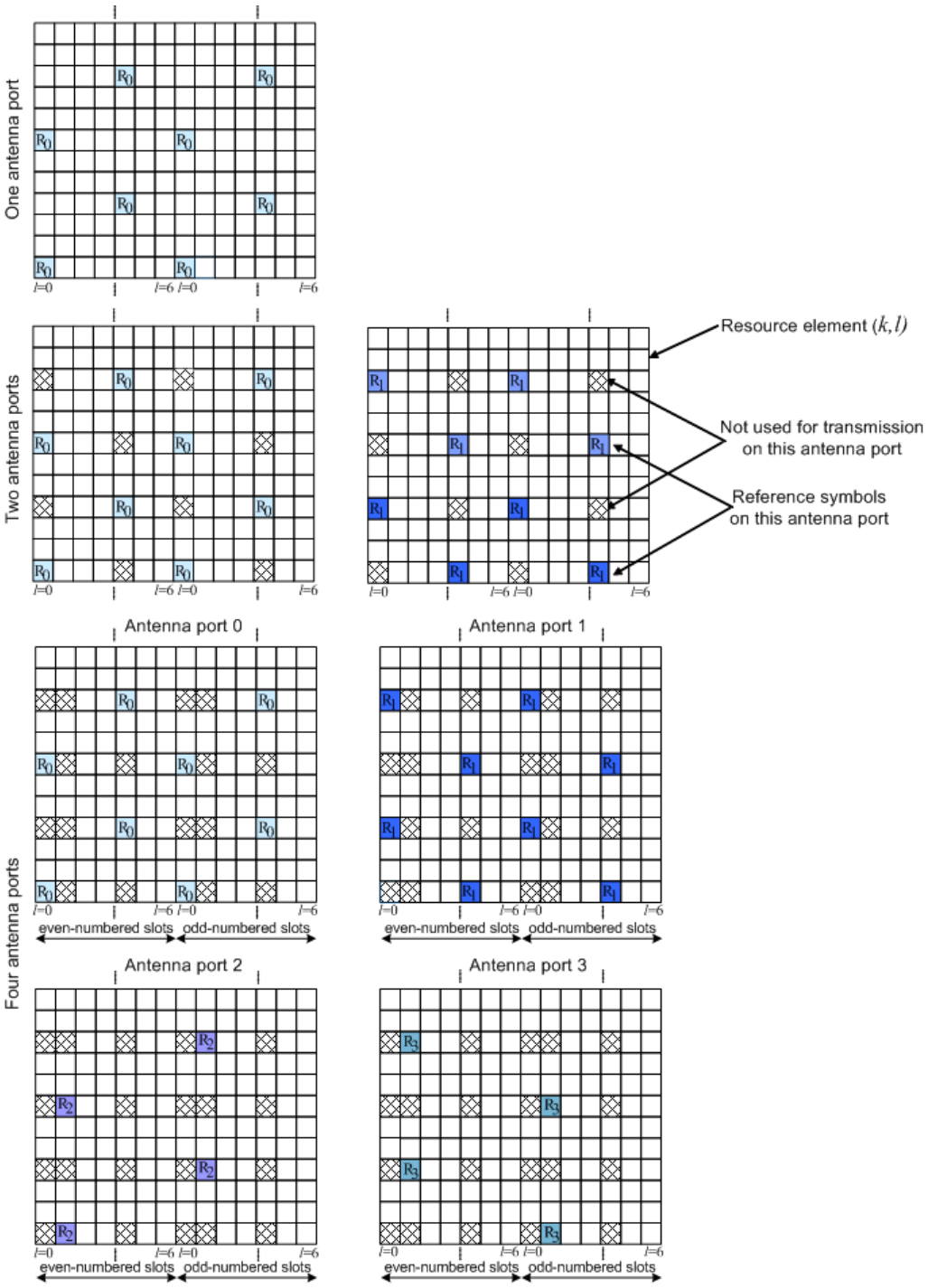



***Fig. 3-9: Downlink Reference Signal Structure (Normal Cyclic Prefix)***

The reference signal sequence carries the cell identity. There are 504 unique physical layer cell identities, grouped into 168 unique physical cell identity groups that contain three unique identities each. Each reference signal is generated as a pseudo-random sequence that depends on the physical layer cell identity.

Frequency hopping can be applied to the downlink reference signals. The frequency hopping pattern has a period of one frame (10 ms).

During cell search, different types of information need to be identified by the handset: symbol and radio frame timing, frequency, cell identification, overall transmission bandwidth, antenna configuration, and cyclic prefix length.

Besides the reference signals, synchronization signals are therefore needed during cell search. EUTRA uses a hierarchical cell search scheme similar to WCDMA. This means that the synchronization acquisition and the cell group identifier are obtained from different SYNC signals. Thus, a primary synchronization signal (**P-SYNC**) and a secondary synchronization signal (**S-SYNC**) are defined with a pre-defined structure. They are transmitted on the 72 center subcarriers (around DC subcarrier) within the same predefined slots (twice per 10 ms) on different resource elements, see figure 3-10. This figure is taken from 3GPP TS 36.211, Physical Channels and Modulation (Release 8).

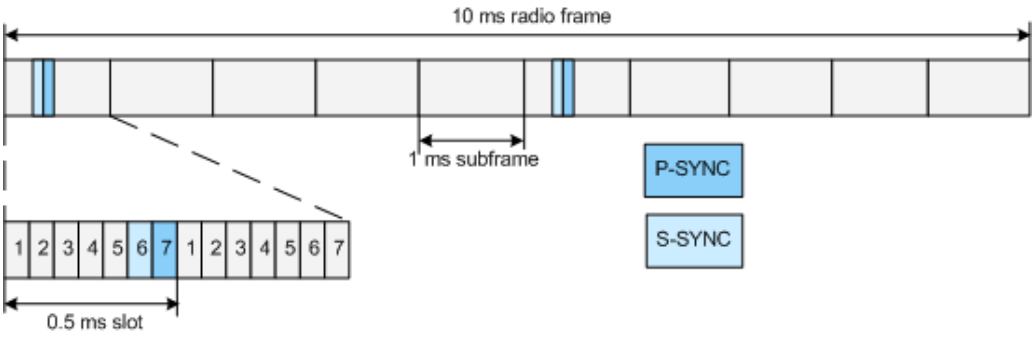



***Fig. 3-10: P-SYNC and S-SYNC Structure (Normal CP; 1.25MHz bandwidth)***

As additional help during cell search, a common control physical channel (CCPCH) is available which carries BCH type of information, e.g. system bandwidth. It is transmitted at predefined time instants on the 72 subcarriers centered around the DC subcarrier.

In order to enable the UE to support this cell search concept, it was agreed to have a minimum UE bandwidth reception capability of 20 MHz.

For information on the related settings, refer to chapter 7.10.7.2, "Synchronization Signal Settings", on page 137.

### 3.2.5.2 MBSFN reference signals

MBSFN reference signals are defined fro extended cyclic prefix only. The MBSFN reference signals are transmitted on antenna port 4 and only when the PMCH is transmitted.

The figure 3-11 shows the resource elements used by the MBSFN reference signal in case of Δf=15 kHz .

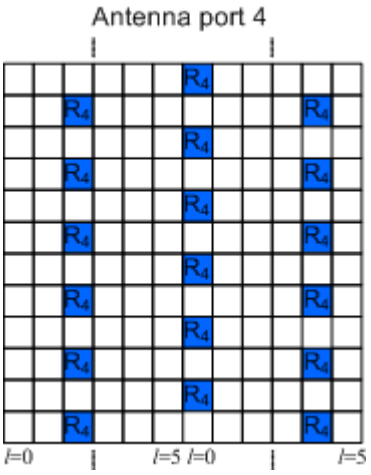



*Fig. 3-11: MNSFN reference signal structure (extended cyclic prefix, carrier spacing 15 KHz)*

For information on the related settings, refer to chapter 7.10.2, "MBSFN Settings", on page 115.

#### 3.2.5.3 UE-specific reference signal (DM-RS)

These reference signals are intended for a specific user and mapped to predefined PDSCH RBs of this particular user. The resource elements predefined for the UE-specific RS do not overlap with the resource elements reserved for the cell-specific reference signals.

In case of single-antenna transmission, the UE-specific reference signals are transmitted on antenna port 5, 7 or 8. If a spatial multiplexing is applied, the UE-specific reference signals are transmitted on antenna ports 7 and 8.

The UE-specific RS are also called demodulation reference signals (DM-RS) and are intended for channel estimation and demodulation instead of the common reference signals. One typical example of the application of UE-specific RS is the channel estimation and demodulation in case of beamforming transmission, also called transmission using antenna port 5.

In contrary to the common RS that are not precoded, the UE-specific RS are precoded in the same way as the PDSCH they are mapped to.

The following figures show the mapping of the UE-specific reference signals to the resource elements.

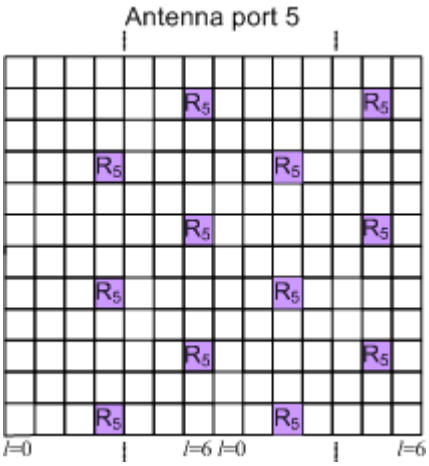



*Fig. 3-12: UE-specific reference signals, antenna port 5 (normal cyclic prefix)*

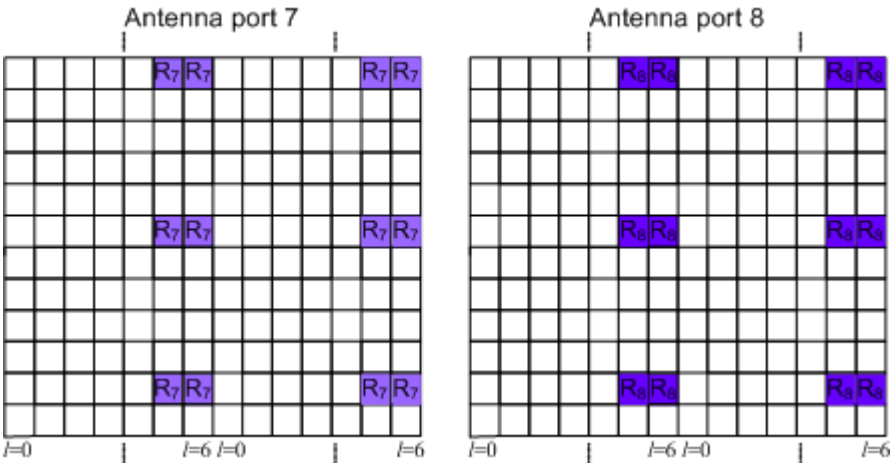



*Fig. 3-13: UE-specific reference signals, antenna ports 7 and 8 (normal cyclic prefix, downlink subframe)*

### 3.2.5.4 Positioning reference signals

The positioning reference signals are transmitted only in downlink subframes configured for positioning reference signals transmission. Positioning reference signals are transmitted on antenna port 6.

The figure 3-14 shows the mapping of the positioning reference signals for the one and two PBCH antenna ports case (normal cyclic prefix). Refer to the specification for information about the mapping in all other cases.

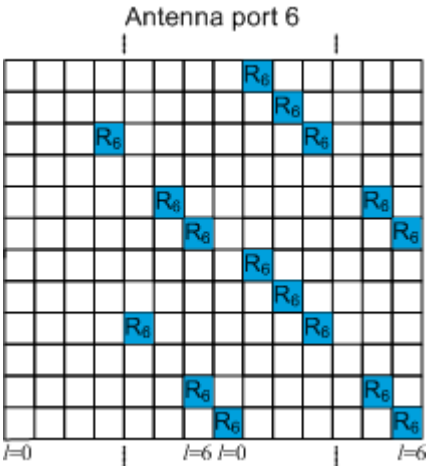



*Fig. 3-14: Mapping of PRS (normal cyclic prefix), one and two PBCH antenna ports.*

For information on the related settings, refer to chapter 7.10.8, "Positioning Reference Signal (PRS) Settings", on page 137 .

### 3.2.5.5 CSI reference signals

The CSI reference signals (CSI-RS) are intended for the acquisition of channel-state information (CSI) for UE working in transmission mode 9 (TM9), because in TM9, the DM-RS are used for channel estimation.

The CSI-RS structure depends on the number of CSI-RS (one, two, four or eight) configured in a cell and can differ between the cells (see also figure 3-15).

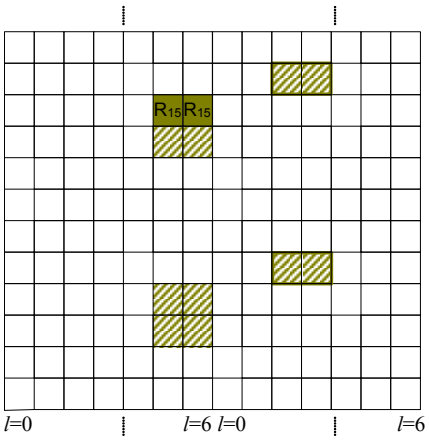



*Fig. 3-15: Mapping of a CSI-RS on antenna port 15 (CSI configuration 0, normal cyclic prefix) [3]*

pattern = egsample of possible position of the CSI-RSs
dark green = example of a allocated CSI-RS in a cell
border = example of muted (ZeroTxPower) CSI-RSs

The CSI-RS can be configured with different transmission periods (between 5 and 80 ms) and per subframe (see table 7-8).

In normal operation, the CSI-RS is transmitted on the allocated resource elements (dark green color on figure 3-15) whereas the remaining possible but not allocated resource elements (the pattern elements on the figure) are used for PDSCH transmission. The 3GPP specification allows the configuration of an additional subset of resource elements, that are reserved for CSI-RS transmission, have the same structure as the CSI-RS but use a zero transmission power (ZeroTxPower), i.e. nothing is actually transmitted.

For description of the related settings, refer to:

- chapter 7.10.9, "CSI Settings", on page 140
- chapter 7.12.2, "CSI-RS Settings", on page 193
- "CSI Awareness" on page 152

### 3.2.6 Downlink Physical Layer Procedures

For E-UTRA, the following downlink physical layer procedures are especially important:

- **Cell search and synchronization**
  See chapter 3.2.5.1, "Cell-specific downlink reference signals", on page 23.
- **Scheduling**
  Scheduling is done in the base station (eNodeB). The downlink control channel PDCCH informs the users about their allocated time/frequency resources and the transmission formats to use. The scheduler evaluates different types of information, e.g. quality of service parameters, measurements from the UE, UE capabilities, and buffer status.
- **Link adaptation**
  Link adaptation is already known from HSDPA as adaptive modulation and coding. Also in E-UTRA, modulation and coding for the shared data channel is not fixed, but rather is adapted according to radio link quality. For this purpose, the UE regularly reports channel quality indications (CQI) to the eNodeB.
- **Hybrid automatic repeat request (ARQ)**
  Downlink hybrid ARQ is also known from HSDPA. It is a retransmission protocol. The UE can request retransmissions of incorrectly received data packets.

## 3.3 LTE Uplink Transmission Scheme

During the study item phase of LTE, alternatives for the optimum uplink transmission scheme were investigated. While OFDMA is seen optimum to fulfill the LTE requirements in downlink, OFDMA properties are less favorable for the uplink. This is mainly due to weaker peak-to-average power ratio (PAPR) properties of an OFDMA signal, resulting in worse uplink coverage.

Thus, the LTE uplink transmission scheme for FDD and TDD mode is based on SC-FDMA (Single Carrier Frequency Division Multiple Access) with cyclic prefix. SC-FDMA signals have better PAPR properties compared to an OFDMA signal. This was one of the main reasons for selecting SC-FDMA as LTE uplink access scheme. The PAPR characteristics are important for cost-effective design of UE power amplifiers. Still, SC-FDMA signal

processing has some similarities with OFDMA signal processing, so parameterization of downlink and uplink can be harmonized.

There are different possibilities how to generate an SC-FDMA signal. DFT-spread-OFDM (DFT-s-OFDM) has been selected for EUTRA. The principle is illustrated in the figure below. This figure is taken from 3GPP R1-050584, "EUTRA Uplink Numerology and Design".

For DFT-s-OFDM, a size-M DFT is first applied to a block of M modulation symbols. QPSK, 16QAM and 64 QAM are used as uplink EUTRA modulation schemes, the latter being optional for the UE. The DFT transforms the modulation symbols into the frequency domain. The result is mapped onto the available subcarriers. In EUTRA uplink, only localized transmission on consecutive subcarriers is allowed. An N point IFFT where N>M is then performed as in OFDM, followed by addition of the cyclic prefix and parallel to serial conversion.

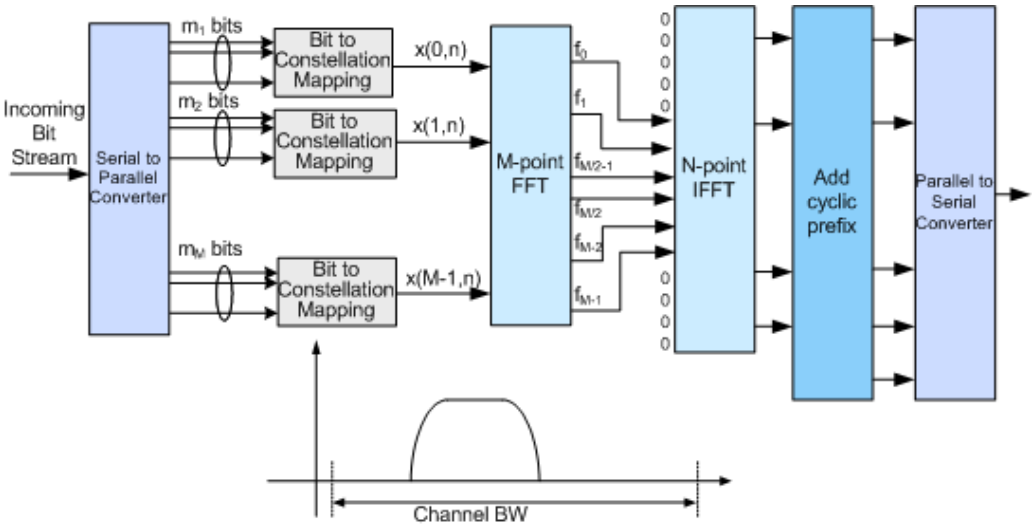



***Fig. 3-16: Block Diagram of DFT-s-OFDM (Localized Transmission)***

The DFT processing is therefore the fundamental difference between SC-FDMA and OFDMA signal generation. This is indicated by the term DFT-spread-OFDM. In an SCFDMA signal, each sub-carrier used for transmission contains information of all transmitted modulation symbols, since the input data stream has been spread by the DFT transform over the available sub-carriers. In contrast to this, each sub-carrier of an OFDMA signal only carries information related to specific modulation symbols.

### 3.3.1 SC-FDMA Parameterization

The EUTRA uplink structure is similar to the downlink. An uplink radio frame consists of 20 slots of 0.5 ms each, and 1 subframe consists of 2 slots. The slot structure is shown in the figure below. This figure is taken from 3GPP TS 36.211, Physical Channels and Modulation (Release 8).

Each slot carries $N_{symb}^{UL}$ SC-FDMA symbols, where $N_{symb}^{UL}$ = 7 for the normal cyclic prefix and $N_{symb}^{UL}$ = 6 for the extended cyclic prefix. SC-FDMA symbol number 3 (i.e. the 4th symbol in a slot) carries the reference signal for channel demodulation.

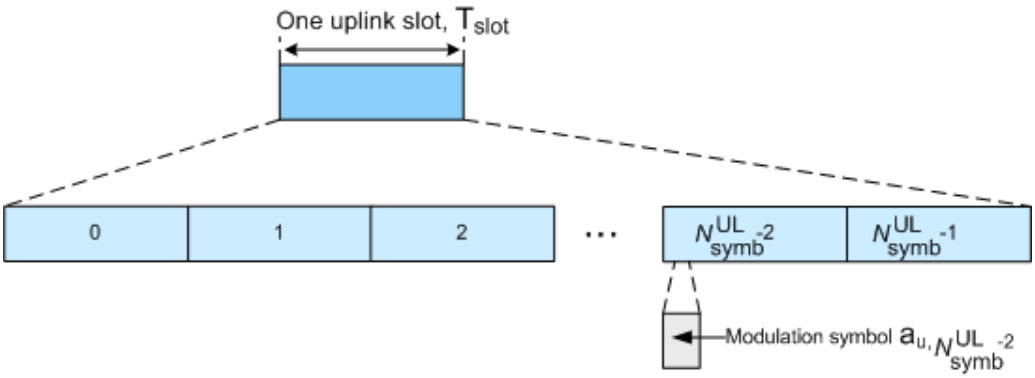



*Fig. 3-17: Uplink Slot Structure*

Also for the uplink, a bandwidth agnostic layer 1 specification has been selected. The table below shows the configuration parameters in an overview table.

| Configuration | Number of symbols $N^{UL}_{symb}$ | Cyclic Prefix length in samples | Cyclic Prefix length in us |
|---|---|---|---|
| Normal cyclic prefix<br>Δf=15 kHz | 7 | 160 for first symbol<br>144 for other symbols | 5.2 us for first symbol<br>4.7 us for other symbols |
| Extended cyclic prefix<br>Δf=15 kHz | 6 | 512 | 16.7 us |

For information on the related settings, refer to chapter 7.1, "General Settings", on page 75, chapter 7.10.6, "TDD Frame Structure Settings", on page 135, .chapter 7.15.2, "SC-FDMA Timeplan", on page 217 and chapter 7.19, "TDD Timeplan", on page 260.

### 3.3.2 Uplink Data Transmission

In uplink, data is allocated in multiples of one resource block. Uplink resource block size in the frequency domain is 12 sub-carriers, i.e. the same as in downlink. However, not all integer multiples are allowed in order to simplify the DFT design in uplink signal processing. Only factors 2, 3, and 5 are allowed.

The uplink transmission time interval (TTI) is 1 ms (same as downlink).

User data is carried on the Physical Uplink Shared Channel (**PUSCH**).

For information on the related settings, refer to chapter 7.14.6, "PUSCH Structure", on page 211, chapter 7.16.5, "Physical Uplink Shared Channel (PUSCH)", on page 236 and chapter 7.17, "Enhanced PUSCH Settings", on page 250.

### 3.3.3 Uplink Control Information Transmission

In uplink, the control information is carried by the Physical Uplink Shared Channel (PUSCH) or by the Physical Uplink Control Channel (PUCCH), depending on whether an uplink resource has been assigned to the user or not.

Control information (CQI reports and ACK/NACK information related to data packets received in the downlink) is multiplexed with the PUSCH, if the user has been granted with UL-SCH transmission.

The PUCCH carries uplink control information, e.g. CQI reports, HARQ ACK/NACK information or Scheduling Requests (SR), in case the user has not been assigned an UL-SCH transmission. The PUCCH is transmitted on a reserved frequency region at the edges of the total available bandwidth in the UL. One PUCCH resource comprises a pair of resource blocks within slot 0 and 1 that are located in the upper and the lower part of the spectrum. PUCCH is allocated as shown on the figure 3-18 (taken from 3GPP TS 36.211, Physical Channels and Modulation (Release 8)).

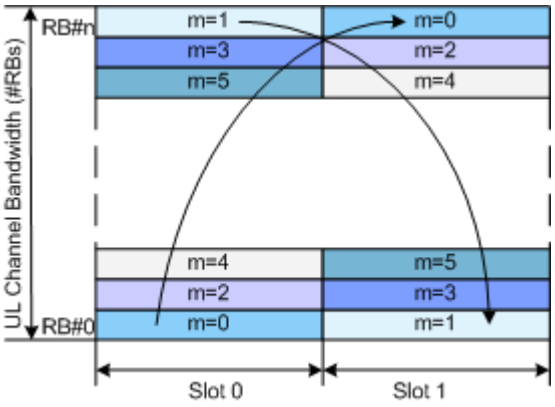



*Fig. 3-18: PUCCH Mapping*

According to 3GPP 36.211, seven PUCCH formats are defined (see table 3-2).

*Table 3-2: PUCCH formats*

| PUCCH format | Description | Physical Bits | Modulation Scheme | ODFM Symbols used for DRS (normal CP) | ODFM Symbols used for DRS (extended CP) |
|---|---|---|---|---|---|
| 1 | Scheduling Request | 0 | - | 2, 3, 4 | 2, 3 |
| 1a | ACK/NACK | 1 | BPSK | 2, 3, 4 | 2, 3 |
| 1b | ACK/NACK for MIMO | 2 | QPSK | 2, 3, 4 | 2, 3 |
| 2 | CQI | 20 | QPSK | 1, 5 | 3 |
| 2a | CQI and ACK/NACK | 21 | QPSK+BPSK | 1, 5 | - |

| PUCCH format | Description | Physical Bits | Modulation Scheme | ODFM Symbols used for DRS (normal CP) | ODFM Symbols used for DRS (extended CP) |
|---|---|---|---|---|---|
| 2b | CQI and ACK/ NACK for MIMO | 22 | QPSK+QPSK | 1, 5 | - |
| 3 | ACK/NACK if DL carrier aggregatin with more than 2 cells | 48 | QPSK | 1, 5 | 3 |

The different PUCCH formats are mapped to the reserved PUCCH region, so that there can be only one resource block per slot that supports a combination of PUCCH formats 1/1a/1b and 2/2a/2b.

For simultaneous transmission of multiple users on the PUCCH, different PUCCH resource indices are used. Multiple users are distinguished within one resource block by using different cyclic shifts (CS) of the CAZAC (Constant Amplitude Zero Auto-Correlation) sequence. For PUCCH formats 1/1a/1b additionally three different orthogonal cover sequences (OC) can be used. For the different PUCCH formats, different number of PUCCH resource indices are available within a resource block (see table below). The actual number of the used orthogonal sequences is additionally determinate by the parameter delta_shift, used to support working by different channel conditions.

| PUCCH format | PUCCH resource indices | number available within a resource block |
|---|---|---|
| 1/1a/1b | N(1)_PUCCH | 36 for normal CP<br>24 for extended CP |
| 2/2a/2b | N(2)_PUCCH | 12 |
| 3 | N(3)_PUCCH | 5 |

For information on the related settings, refer to chapter 7.14.7, "PUCCH Structure", on page 212 and chapter 7.18, "Enhanced PUCCH Settings", on page 256.

### 3.3.4 Uplink Reference Signal Structure

Uplink reference signals are used for two different purposes: on the one hand, they are used for channel estimation in the eNodeB receiver in order to demodulate control and data channels. On the other hand, the reference signals provide channel quality information as a basis for scheduling decisions in the base station. The latter purpose is also called channel sounding.

The uplink reference signals are based on CAZAC (Constant Amplitude Zero Auto- Correlation) sequences.

For information on the related settings, refer to chapter 7.14.4.1, "UL Reference Signals", on page 207, chapter 7.14.4.2, "SRS Structure", on page 208, chapter 7.16.6,

"Reference Signal Structure", on page 238 and chapter 7.16.7, "SRS Structure", on page 240.

### 3.3.5 Uplink Physical Layer Procedures

For EUTRA, the following uplink physical layer procedures are especially important:

**Non-synchronized random access**

The random access may be used to request initial access, as part of handover, when transiting from idle to connected, or to re-establish uplink synchronization. The structure is shown in the figure below. This figure is taken from 3GPP TS 36.211, Physical Channels and Modulation (Release 8).

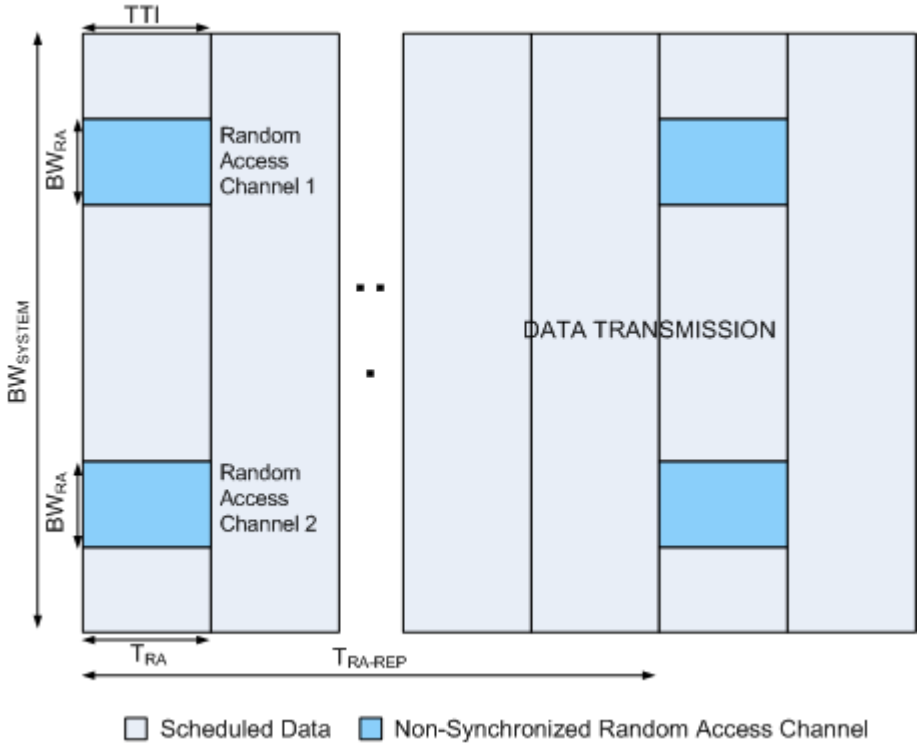



***Fig. 3-19: Random Access Structure, principle***

Multiple random access channels may be defined in the frequency domain within one access period TRA in order to provide a sufficient number of random access opportunities.

For the random access, a preamble is defined as shown in the figure below. This figure is taken from 3GPP TS 36.211, Physical Channels and Modulation (Release 8). The preamble length depends on the preamble format. The preamble bandwidth is 1.08 MHz (72 subcarriers). Higher layer signaling controls in which subframes the preamble transmission is allowed, and the location in the frequency domain. Per cell, there are 64 random access preambles. They are generated from Zadoff-Chu sequences.

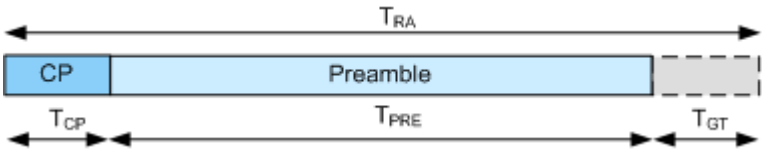



*Fig. 3-20: Random Access Preamble*

The random access procedure uses open loop power control with power ramping similar to WCDMA. After sending the preamble on a selected random access channel, the UE waits for the random access response message. If no response is detected then another random access channel is selected and a preamble is sent again.

For information on the related settings, refer to chapter 7.14.5, "PRACH Settings", on page 209, chapter 7.16.8, "PRACH Power Ramping", on page 246 and chapter 7.16.9, "PRACH Configuration", on page 247.

### Uplink scheduling

Scheduling of uplink resources is done by eNodeB. The eNodeB assigns certain time/ frequency resources to the UEs and informs UEs about transmission formats to use. Scheduling decisions affecting the uplink are communicated to the UEs via the Physical Downlink Control Channel (PDCCH) in the downlink. The scheduling decisions may be based on QoS parameters, UE buffer status, uplink channel quality measurements, UE capabilities, UE measurement gaps, etc.

### Uplink link adaptation

As uplink link adaptation methods, transmission power control, adaptive modulation and channel coding rate, as well as adaptive transmission bandwidth can be used.

### Uplink timing control

Uplink timing control is needed to time align the transmissions from different UEs with the receiver window of the eNodeB. The eNodeB sends the appropriate timing-control commands to the UEs in the downlink, commanding them to adapt their respective transmit timing.

### Hybrid automatic repeat request (ARQ)

The Uplink Hybrid ARQ protocol is already known from HSUPA. The eNodeB has the capability to request retransmissions of incorrectly received data packets.

## 3.4 LTE MIMO Concepts

Multiple Input Multiple Output (MIMO) systems form an essential part of LTE in order to achieve the ambitious requirements for throughput and spectral efficiency. MIMO refers to the use of multiple antennas at transmitter and receiver side.

### 3.4.1 Downlink MIMO

For the LTE downlink, a 2x2 configuration for MIMO is assumed as baseline configuration, i.e. 2 transmit antennas at the base station and 2 receive antennas at the terminal side. Configurations with 4 or more antennas are also being considered.

Different MIMO modes are envisaged. It has to be differentiated between spatial multiplexing and transmit diversity, and it depends on the channel condition which scheme to select.

For information on the related settings, refer to

- chapter 7.10.10, "Antenna Ports Settings", on page 144
- chapter 7.12.1, "Precoding Settings", on page 189
- chapter 7.13, "Antenna Port Mapping Settings", on page 197.

#### 3.4.1.1 Spatial Multiplexing

Spatial multiplexing allows transmitting different streams of data simultaneously on the same downlink resource block(s). These data streams can belong to one single user (single user MIMO / SU-MIMO) or to different users (multi user MIMO / MU-MIMO). While SU-MIMO increases the data rate of one user, MU-MIMO allows increasing the overall capacity. Spatial multiplexing is only possible if the mobile radio channel allows it. The figure below shows the principle of spatial multiplexing, exploiting the spatial dimension of the radio channel which allows transmitting the different data streams simultaneously.

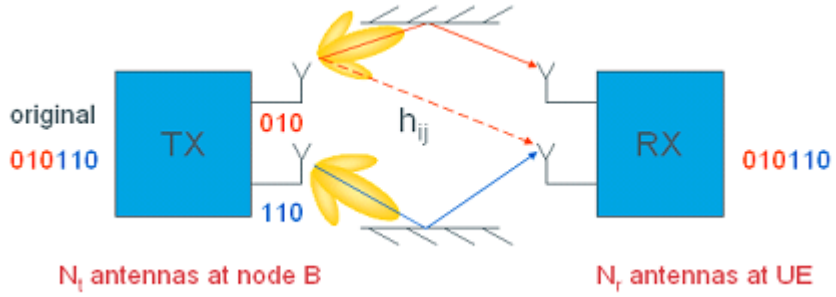



*Fig. 3-21: Spatial multiplexing*

In the figure above, each transmit antenna transmits a different data stream. Each receive antenna may receive the data streams from all transmit antennas. The channel (for a specific delay) can thus be described by the following channel matrix H:

$$H = \begin{bmatrix} h_{11} & h_{12} & \cdots & h_{1N_t} \\ h_{21} & h_{22} & & h_{2N_t} \\ \vdots & & \ddots & \vdots \\ h_{N_r1} & h_{N_r2} & \cdots & h_{N_rN_t} \end{bmatrix} \quad \begin{matrix} \leftarrow N_t \rightarrow \\ \\ \\ \\ \updownarrow N_r \end{matrix}$$

In this general description, $N_t$ is the number of transmit antennas, $N_r$ is the number of receive antennas, resulting in a 2x2 matrix for the baseline LTE scenario. The coefficients $h_{ij}$ of this matrix are called channel coefficients from transmit antenna *j* to receive antenna *i*, thus describing all possible paths between transmitter and receiver side.

The number of data streams that can be transmitted in parallel over the MIMO channel is given by min {$N_t$, $N_r$} and is limited by the rank of the matrix H. The transmission quality degrades significantly in case the singular values of matrix H are not sufficiently strong. This can happen in case the 2 antennas are not sufficiently de-correlated, for example in an environment with little scattering or when antennas are too closely spaced.

### Codewords and spatial layers

A block of information bits that can be separately procesed bofore it is transmitted in a subframe, is called codeword [17].

A spatial layer indicates the number of spatial streams that can be simultaneously transmitted [17]. The number of layers for transmission is less than or equal to the number of transmit antenna ports and depends on the rank of the matrix H.

In LTE, up to 2 codewords can be transmitted simultaneously and mapped onto different layers. There is a fixed mapping between codewords to layers.

### Precoding

Precoding on transmitter side is used to support spatial multiplexing, see figure below. This is achieved by applying a precoding matrix W to the signal before transmission. The figure is taken from [3] 3GPP TS 36.211, Physical Channels and Modulation (Release 8).

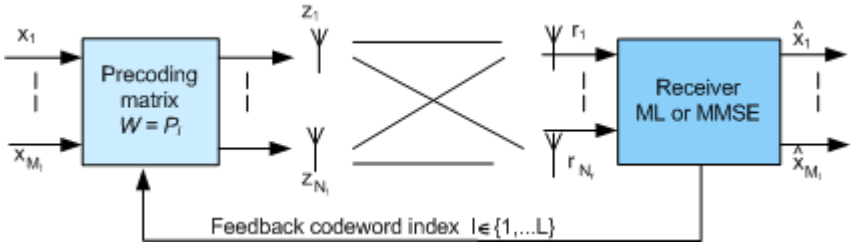



***Fig. 3-22: Precoding principle***

The optimum precoding matrix W is selected from a predefined "codebook" which is known at eNodeB and UE side. Unitary precoding is used, i.e. the precoding matrices are unitary: $W^H W = I$. The UE estimates the radio channel and selects the optimum precoding matrix. The optimum precoding matrix is the one which offers maximum capacity. The UE provides feedback on the uplink control channel regarding the preferred precoding matrix (precoding vector as a special case). Ideally, this information is made available per resource block or at least group of resource blocks, since the optimum precoding matrix varies between resource blocks. Figure below gives an overview of EUTRA downlink baseband signal generation including the above-mentioned steps relevant for MIMO transmission. This figure is taken from [3] 3GPP TS 36.211, Physical Channels and Modulation (Release 8).

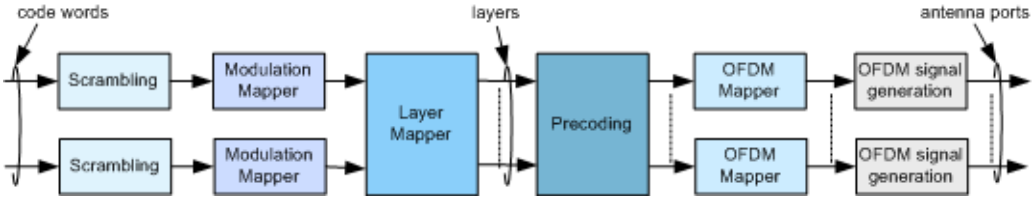



*Fig. 3-23: Overview of downlink baseband signal generation*

### Transmission modes

LTE defines the following transmission modes for the PDSCH [5].

*Table 3-3: Transmission modes overview*

| Transmission mode | Transmission scheme |
|---|---|
| Tx Mode 1 | Single-antenna transmission (antenna port 0), no MIMO |
| Tx Mode 2 | Transmit diversity |
| Tx Mode 3 | • Transmit diversity<br>• Open-loop spatial multiplexing with large delay CDD |
| Tx Mode 4 | • Transmit diversity<br>• Closed-loop spatial multiplexing |
| Tx Mode 5 | • Transmit diversity<br>• Multi-user MIMO |
| Tx Mode 6 | • Transmit diversity<br>• Closed-loop spatial multiplexing using a single transmission layer |
| Tx Mode 7 (Beamforming) | Single-antenna port transmission; antenna port 5 |
| Tx Mode 8 | • Dual layer transmission; antenna ports 7 and 8<br>• Single-antenna port; antenna ports 7 or 8 |
| Tx Mode 9 | Multi layer transmission; antenna ports 9 to 14 |

### 3.4.1.2 Transmit Diversity

Instead of increasing data rate or capacity, MIMO can be used to exploit diversity. Transmit diversity schemes are already known from WCDMA release 99 and will also form part of LTE as one MIMO mode. In case the channel conditions do not allow spatial multiplexing, a transmit diversity scheme will be used instead, so switching between these two MIMO modes is possible depending on channel conditions. Transmit diversity is used when the selected number of streams (rank) is one.

### 3.4.1.3 Beamforming

The beamforming is a method to shape the transmitted signal in the receiver's direction. In LTE, the beamforming is defined as transmission mode 7, 8 and 9 (Tx Mode 7/8/9). Beamforming uses the special virtual antenna ports 5 and 7 to 14.

The channel estimation in a beamforming scenario is based on the UE-specific reference signal (DM-RS).

### 3.4.2 Uplink MIMO

Uplink MIMO schemes for LTE will differ from downlink MIMO schemes to take into account terminal complexity issues. For the uplink, MU-MIMO can be used. Multiple user terminals may transmit simultaneously on the same resource block. This is also referred to as spatial domain multiple access (SDMA). The scheme requires only one transmit antenna at UE side which is a big advantage. The UEs sharing the same resource block have to apply mutually orthogonal pilot patterns.

To exploit the benefit of two or more transmit antennas but still keep the UE cost low, antenna subset selection can be used. In the beginning, this technique will be used, e.g. a UE will have two transmit antennas but only one transmits chain and amplifier. A switch will then choose the antenna that provides the best channel to the eNodeB.

## 3.5 LTE MBMS Concepts

Support of MBMS (Multimedia Broadcast Multicast Services) is an essential requirement for LTE. The so-called E-MBMS will therefore be an integral part of LTE.

In LTE, MBMS transmissions may be performed as single-cell transmission or as multi-cell transmission. In case of multi-cell transmission the cells and content are synchronized to enable for the terminal to soft-combine the energy from multiple transmissions. The superimposed signal looks like multipath to the terminal. This concept is also known as Single Frequency Network (SFN). The EUTRAN can configure which cells are part of an SFN for transmission of an MBMS service. The MBMS traffic can share the same carrier with the unicast traffic or be sent on a separate carrier. For MBMS traffic, an extended cyclic prefix is provided. In case of subframes carrying MBMS SFN data, specific reference signals are used (see chapter 3.2.5.2, "MBSFN reference signals", on page 25).

MBMS data is carried on the MBMS traffic channel (MTCH) as logical channel. The MBMS control information is conveyed by the MBMS control channel MCCH. Both logical channels, the MTCH and the MCCH, are mapped onto the physical multicast channel PMCH in the multi-cell transmission case and on the PDSCH in case a single-cell transmission is used.

For information on the related settings, refer to chapter 7.10.2, "MBSFN Settings", on page 115.

## 3.6 LTE-Advanced Introduction

In September 2009 the 3GPP Partners made a formal submission to the ITU proposing that LTE Release 10 & beyond (LTE-Advanced) should be evaluated as a candidate for IMT-Advanced.

This description gives a brief description only of the LTE-A features currently covered by the software option R&S SMW-K85. The full set of LTE-Advanced features is described in [20].

For a complete LTE-Advanced technology introduction and an insight description of the LTE-A features, refer to the following Rohde & Schwarz documents:

- Withe Paper 1MA169 "LTE-Advanced Technology Introduction" [18]
- Application Note 1MA166 “LTE-Advanced Signals Generation and –Analysis” [19]

The last two documents can be found in the official Rohde & Schwarz internet site > Download Area > Application Notes: http://www2.rohde-schwarz.com/en/service_and_support/Downloads/Application_Notes/

### 3.6.1 Carrier Aggregation

To fulfill the requirements to even higher data rates as in the LTE Rel. 8, the LTE-A Rel. 10 specification uses the aggregation of multiple LTE carrier. Two or more component carrier (CC) are grouped in order to support wider transmission bandwidths up to 100MHz. To an LTE REl. 8 terminal, each component carrier will appear as an LTE carrier, while an LTE Rel 10 terminal can exploit the total aggregated bandwidth. As backward compatibility is fulfilled, a LTE-advanced cell can serve both LTE Rel 8 and LTE Rel 10 terminals simultaneously.

Spectrum deployment may be either contiguous with adjacent component carriers, or non-contiguous with non-adjacent component carriers (see figure 3-24). The individual component carriers may belong to the same frequency band (intra-band) or even to different frequency bands (inter-band). Component carriers transmitted by the same eNodeB provide the same cell coverage.

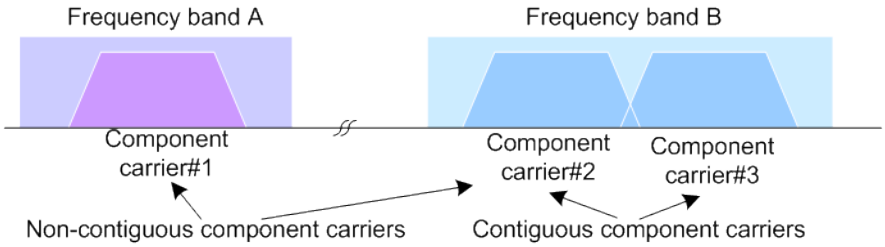



***Fig. 3-24: Carrier aggregation [18]***

The LTE-A specification defines two different approaches about informing the UE about the scheduling for each band: a separate PDCCH for each carrier or a common PDCCH for multiple carriers (cross-carrier scheduling).

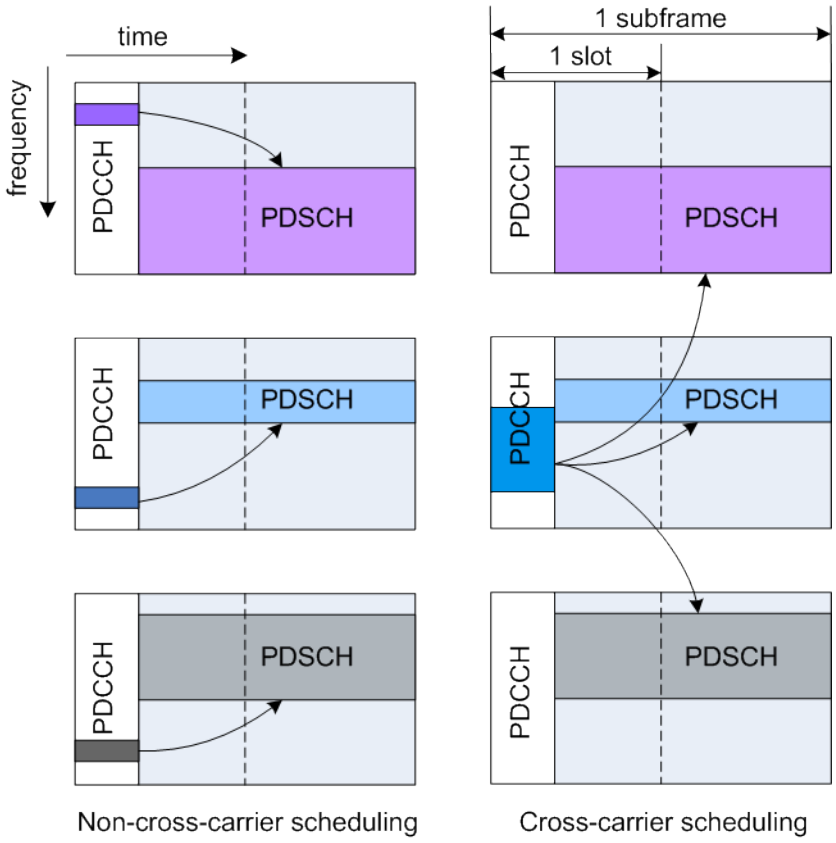



*Fig. 3-25: LTE-A scheduling approaches*

In the dedicated/non-cross-carrier approach, the PDCCH on a component carrier assigns PDSCH resources on the same component carrier. The used PDCCH structure is identical to the LTE Rel. 8/9 PDCCH structure.

In the cross-carrier approach, the PDCCH on a component carrier assigns resources on one of multiple component carriers. The component carriers are identified by the new introduced DCI field, the CIF (carrier indicator field).

For information on the related settings, refer to chapter 7.10.1, "DL Carrier Aggregation Configuration", on page 107, chapter 7.11, "DL Frame Configuration Settings", on page 146 and chapter 7.11.3, "User Configuration Settings", on page 148.

## 3.6.2 Enhanced Uplink SC-FDMA

The LTE-A Rel 10 enhances the uplink transmission scheme compared to the LTE Rel. 8 uplink with the following:

- Control-data decoupling
  In LTE Rel 8/9 a UE only uses physical uplink control channel (PUCCH) when it does not have any data to transmit on PUSCH. I.e. if a UE has data to transmit on PUSCH, it would multiplex the control information with data on PUSCH. This is not longer valid in LTE-Advanced, which means that simultaneous PUCCH and PUSCH transmission is possible in uplink direction.

- Non-contiguous data transmission
  LTE-Advanced extends the uplink transmission scheme by allowing clustered PUSCH, i.e. the uplink transmission is not anymore restricted to the use of consecutive subcarriers, but clusters of resource blocks may be allocated (two "Sets" of consecutive PUSCH resource block groups according to resource allocation type 1 as defined in TS 36.213).

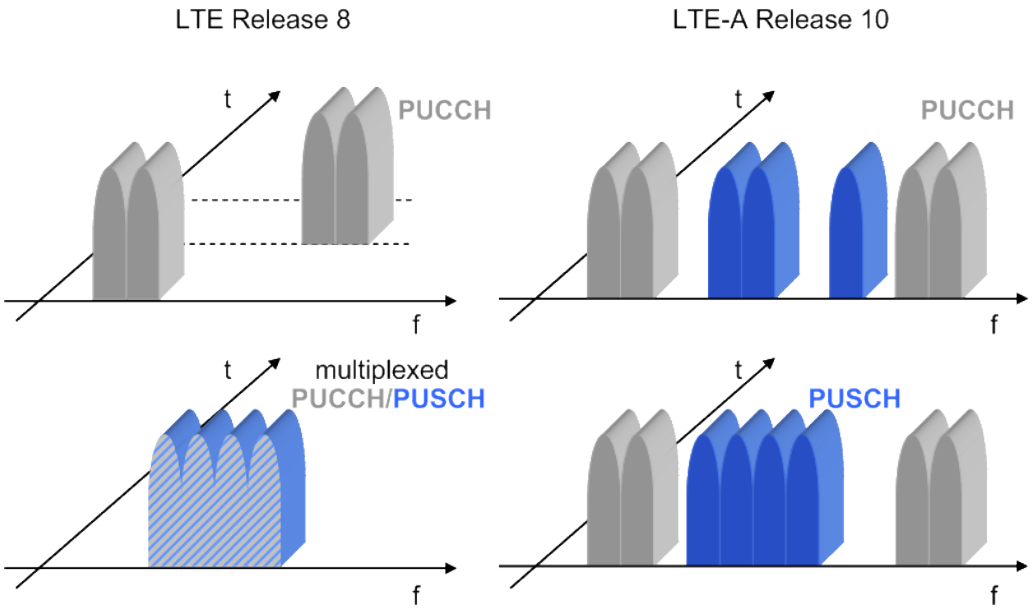



*Fig. 3-26: LTE release 8 and LTE-A Release 10 UL transmission schemes [18]*

For information on the related settings, refer to chapter 7.15, "UL Frame Configuration Settings", on page 215 and chapter 7.16, "User Equipment Configuration", on page 224.

# 4 EUTRA/LTE Parameterization

## 4.1 OFDMA Parameterization

- OFDMA physical layer parameterization is based on a bandwidth agnostic layer 1. However, current 3GPP specifications focus on the channel bandwidth listed in table 4-1.
  Additionally, a user defined channel bandwidth can be configured. To configure the bandwidth of the signal to be generated, the desired number of resource blocks can be specified in a range from 6 to 110 resource blocks with a granularity of 1. This results in bandwidths from 1.095 MHz…19.815 MHz.

***Table 4-1: Channel Bandwidth for FDD mode according to 3GPP TS 36.804***

| **Physical Settings** | **1.4 MHz** | **3 MHz** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** |
|---|---|---|---|---|---|---|
| Physical Settings | 6 | 12 | 25 | 50 | 75 | 100 |
| Physical Settings | 73 | 181 | 301 | 601 | 901 | 1201 |
| Physical Settings | **128**, 256, 512, 1024, 2048 | **256**, 512, 1024, 2048 | **512**, 1024, 2048 | **1024**, 2048 | 1536, **2048** | **2048** |

- Both frame structure, frame structure type 1 for FDD and frame structure type 2 for TDD, are supported.
- For frame structure 2 (TDD mode), all special subframe configurations and all uplink-downlink configurations as defined in the 3GPP specification are supported.
- Both normal and extended cyclic prefix can be selected for a subcarrier spacing of 15 kHz. Parameterization of cyclic prefixes is according to 3GPP TS 36.211.
  **Note:**
  In this version, subcarrier spacing is 15 kHz. Subcarrier spacing of 7.5 kHz will be supported in a later version.
- Resource block size is 12 subcarriers in the frequency domain and, depending on the cyclic prefix length, 7 or 6 consecutive OFDM symbols in the time-domain.
  **Note:**
  Resource block size of 24 subcarriers will be supported in a later version.

## 4.2 Reference Signals

- LTE defines one reference signal per downlink antenna port (see table).
  In the R&S SMW, the mapping of the logical antenna ports 4 to 22 to the physcal Tx-antennas is configurable.

*Table 4-2: Mapping of reference signals to antenna ports*

| Antenna Port | Reference Signal |
|---|---|
| AP0 - AP3 | Cell-specific Reference Signals (CS-RS) |
| AP4 | MBSFN-RS |
| AP5 | UE-specific Reference Signals (DM-RS) for single-layer (TM7) |
| AP6 | Positioning Reference Signals (PRS) |
| AP7 - AP8 | UE-specific Reference Signals (DM-RS) for up to 2 layers beam-forming (TM8/TM9) |
| AP9 - AP14 | UE-specific Reference Signals (DM-RS) for multi-layer beam-forming (TM9) |
| AP15 - AP22 | Channel State Information Reference Signals (CSI-RS) |

- The R&S SMW offers a high flexibility in mapping the various antenna ports for the CSI and the UE-specific RS onto the various generated baseband signals with user-definable precoding weights.
- In R&S SMW you select the the cell-specific reference signals (AP 0-3); the instrument adjusts the correct reference signal pattern accordingly. An example for the possible distribution of downlink reference signals for the normal cyclic prefix is shown in figure 3-9. The reference signal pattern for the extended cyclic prefix is also done according to 3GPP TS 36.211.
- Availability of secondary CS-RS reference signal, subcarrier offset of the reference signal sequence in the frequency domain and existence of empty resource elements depend on the antenna selected.
- Reference signal sequences are generated as a pseudo-random sequence. This sequence is determinate by the cell ID, i.e. the combination of 168 physical cell identity groups and the 3 physical layer identities within each physical layer group.
- Generation of reference signals for antenna port 4-22 depend on the availability of MBSFN, PRS, beamformed PDSCHs and CSI-RS.

## 4.3 Synchronization Signal (SYNC)

- Primary and secondary synchronization signal (P-SYNC and S-SYNC) are supported.
- In the FDD mode, the P-SYNC and S-SYNC are located on the last two OFDM symbols of slot (see figure 3-10). By default, the synchronization signals are transmitted in slots 0 and 10 of the radio frame.
- P-SYNC and S-SYNC are transmitted within the center 72/64 subcarriers. Resource blocks containing P-SYNC/ S-SYNC thus have less resource elements available for user data allocation.
- By default, P-SYNC and S-SYNC are enabled but the synchronization signals can be disabled independently in the signal generator.
- Power of the P-SYNC and S-SYNC can be set independently in the signal generator.

## 4.4 Physical Broadcast Channel (PBCH)

- By default, the PBCH is located over 4 consecutive OFDM symbols in the first four OFDM symbols (symbol number 0 .. 3) of slot 1 of subframe 0 for normal CP. The default location of the four PBCH symbols for extended CP start in the second OFDM symbol (symbol number 2..5) of slot 1 of subframe 0. The figure 4-1 shows the default location of PBCH in case of normal CP.

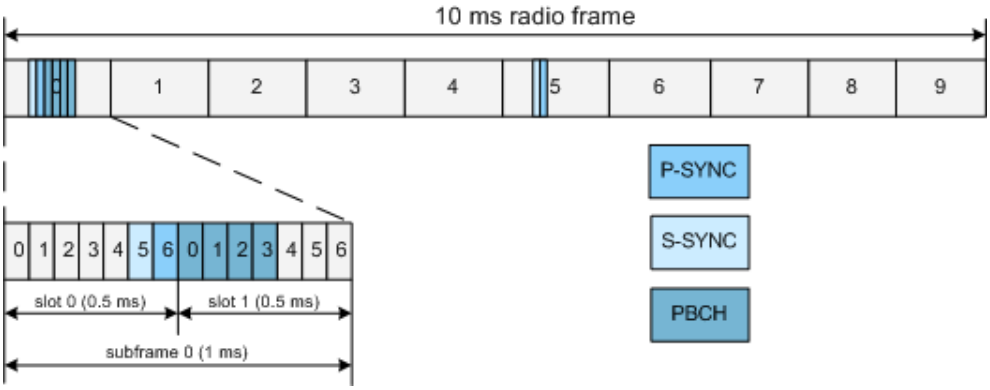



***Fig. 4-1: Default location of PBCH for normal CP***

- PBCH repetition interval is once per frame of 10 ms. Position of PBCH within the subframe 0 is according to 3GPP TS 36.211. However, the R&S SMW allows you to modify the PBCH in terms of PBCH start symbol within the radio subframe (0..13 for normal CP) and length in symbols (1..14 for normal CP).
- PBCH is QPSK modulated; scrambling and channel coding can be additionally activated or deactivated.
- If channel coding is activated, one block of data (Transport Block Size of 24) is coded jointly and then spread over four frames. Hence, the ARB "Sequence Length" has to be set accordingly to be a multiple of four.
- PBCH is occupying the center 72 subcarriers around DC subcarrier.
- With suitable value of the PBCH parameter "SFN Restart Period" ("3GPP 1024 Frames"), the R&S SMW can generate the PBCH with cyclic repeting SFN even if the ARB sequence length is different to 4096 frames.

## 4.5 Physical Control Format Indicator Channel (PCFICH)

- PCFICH is QPSK modulated; scrambling can be additionally activated or deactivated.
- PCFICH is layer mapped and precoded according to 3GPP TS 36.211.
- The power of the PCFICH is configurable.

## 4.6 Physical Hybrid ARQ Indicator Channel (PHICH)

- PHICH is BPSK modulated.

- PHICH is layer mapped and precoded according to 3GPP TS 36.211.
- Different orthogonal sequences are used for the PHICHs within the same PHICH group.
- The power of the PHICH is configurable.

## 4.7 Physical Downlink Control Channel (PDCCH)

- PDCCH is layer mapped, precoded and mapped to the resource elements (incl. permutation and cyclically shifting) according to 3GPP TS 36.211.
- The power of the PDCCH is configurable.
- All DCI formats are supported and can be configured with full flexibility.

## 4.8 Physical Multicast Channel (PMCH)

In this version of the firmware, the following limitations apply:

- The simulated BS belongs to only one MBSFN areas.
  All radio resources reserved for MBSFN subframes are assigned to one MBSFN area, i.e. the MBSFN Area fills all MBSFN subframes signaled by SIB Type 2.
- Only one *MBSFN-SubframeConfig* is configurable.
- One MCCH per MBSFN is supported. The MCCH is mapped to the first active MBFSN subframe within one MCCH repetition period.
- The parameters "Radio frame allocation offset", "MCCH offset" and "Notification offset" are set to identical values in order to simplify the MBSFN configuration.

## 4.9 Data Allocations

- The Physical Resource Block size is 12 subcarriers in the frequency domain for all bandwidth options.
- Localized transmission is assumed.
  For localized transmission, the numbering of resource blocks starts with the left-most (lower frequency) used subcarriers of the frequency band. The numbering starts with zero. With the FFT-shift, the DC carrier is moved to the first position, which is required to be conform to the standard IFFT input. This is illustrated in the figure 4-2.

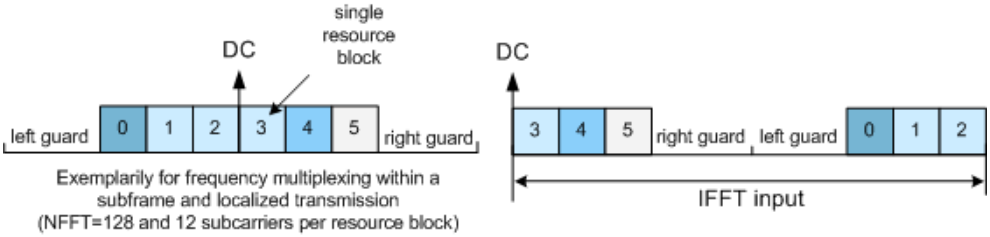



***Fig. 4-2: Numbering of Resource Blocks***

- According to 3GPP 36.211, the modulated data symbols are mapped onto the subcarriers first along the frequency axis starting with the lowest resource block number, then along the available OFDM symbols. This is true also for non-adjacent resource blocks for the same user. This is illustrated in the figure below.

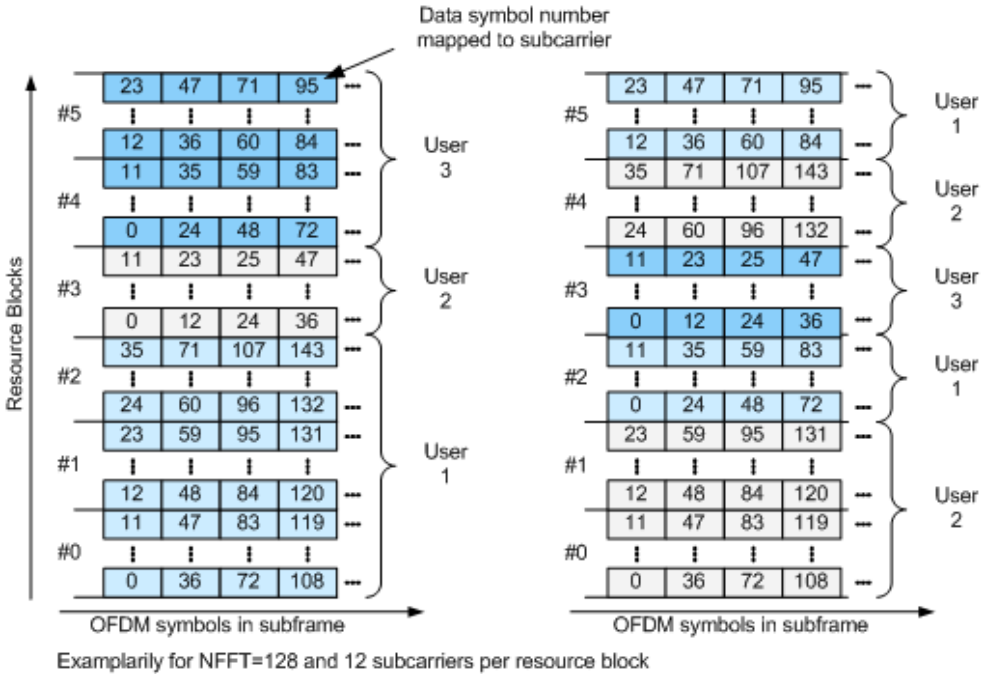



***Fig. 4-3: Data symbol numbering***

- In case pre-defined symbols (e.g. reference symbols, P-SYNC/S-SYNC, PBCH) are transmitted in a subframe, the number of available data symbols for user data allocation is reduced in a resource block.
- Data allocation can be changed for each subframe.
- PDSCH is scrambled, channel coded, precoded and layer mapped according to 3GPP TS 36.211. Additionally, channel coding configuration can be changed per PDSCH data allocations.

## 4.10 Modulation Mapping

The modulation mapping in downlink is done according to 3GPP TS 36.211. All modulation schemes of 3GPP TS 36.211 are supported.

## 4.11 MIMO

- R&S SMW supports all downlink precoding schemes of 3GPP TS 36.211.
- R&S SMW supports all downlink layer mapping schemes of 3GPP TS 36.211.

## 4.12 SC-FDMA Parameterization

- SC-FDMA physical layer parameterization is based on a bandwidth agnostic layer 1. However, current 3GPP specifications focus on the channel bandwidths listed in table 4-1.
  Additionally, a user defined channel bandwidth can be configured. To configure the bandwidth of the signal to be generated, the desired number of resource blocks can be specified in a range from 6 to 110 resource blocks with a granularity of 1. This results in bandwidths from 1.08 MHz…19.8 MHz.
- Both frame structures according to 3GPP TS 36.211 are supported.
- Both normal and extended cyclic prefix are supported.

## 4.13 Demodulation Reference Signal (DRS)

- If the uplink demodulation reference signal (DRS) is multiplexed with the PUSCH, the DRS is carried within the 3rd or 4th SC-FDMA symbol of a slot (i.e. symbol number l = 2 or l=3), depending on the cyclic prefix type. If the DRS is multiplexed with the PUCCH, the SC-FDMA symbol the uplink DRS is carried within depends on the PUCCH format and the cyclic prefix (see table 3-2).
- The demodulation reference signal (DRS) spans the same bandwidth as the data allocation.
- The generation of DRS sequence is according to 3GPP TS 36.211. A CAZAC sequence is used and the DRS is derived from a Zadoff-Chu (ZC) sequence using the extension method.

## 4.14 Sounding Reference Signal (SRS)

- The generation of SRS sequence is according to 3GPP TS 36.211.
- Orthogonality of the SRS signal can also be achieved when using different SRS cyclic shifts.
- No PUSCH is transmitted in the symbol where the sounding reference signal is transmitted.
- PUCCH and SRS are not transmitted in the same subframe, except the transmission of SRS and PUCCH format 1, 1a, 1b or 3 in the same subframe is explicitly enabled for a UE.

## 4.15 Physical Uplink Control Channel (PUCCH)

If R&S FSQ Signal Analyzer is used for signal analysis of signal generated by the R&S Signal Generator equipped with option Digital Standard EUTRA/LTE, be aware that up to Release 2.1 of the LTE Option FSQ-K101 the two resource blocks at each edge of the spectrum are not analyzed.

- Position of PUCCH can be configured in terms of PUCCH region.
- The content of PUCCH can be set individually for each TTI.
- All seven PUCCH formats as defined in the 3GPP TS 36.211 are supported.
- One of 12 cyclic shifts (5 for PUCCH format 3) and for PUCCH formats 1/1a/1b one of three orthogonal codes can be selected indirectly by choosing the appropriate PUCCH index.
- For configuration of multi user PUCCH tests according to 3GPP TS 36.141, annex A9, set the n_PUCCH parameter to the value defined in table A.9-1, column "RS orthogonal cover / ACK/NACK orthogonal cover". The R&S Signal Generator calculates and configures automatically the values defined in the columns "Cyclic shift index" and "Orthogonal cover index".

## 4.16 Physical Random Access Channel (PRACH)

- All PRACH configurations for random access preamble timing for preamble format 0-4 and frame structure type 1 and 2 are supported.

## 4.17 Data Allocation

- Both resource allocation types type 0 and type 1 are supported
- Frequency hopping is supported.
- Resource block size is 12 subcarriers in the frequency domain.
- A generation of uplink signals for up to 4 UEs is supported.
- Data can be allocated per subframe.
- Channel coding is performed according to 3GPP 36.212.
- TTI length is 1 ms.
- The modulated data symbols are mapped onto the resource elements according to 3GPP 36.211.
- Numbering of subcarriers is done according to the figure 4-4.

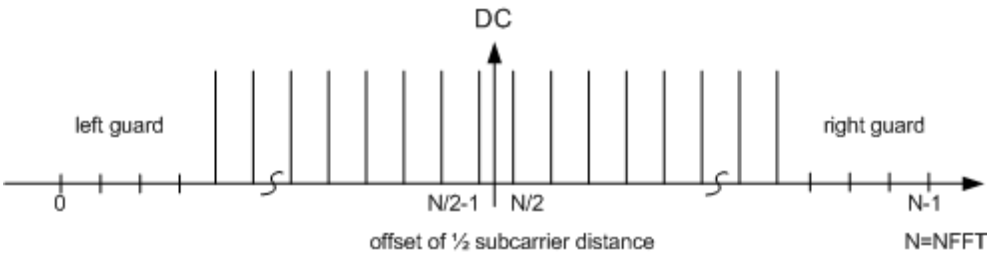



***Fig. 4-4: Numbering of the subcarriers***

- The baseband signal is shifted in the frequency domain by half a subcarrier distance. According to 3GPP 36.211, the spectral shift is carried out symbolwise, i.e. per SC-FDMA symbol.

## 4.18 Modulation Mapping

- The modulation mapping in uplink is done according to 3GPP TS 36.211. All modulation schemes of 3GPP TS 36.211 are supported.

# 5 R&S Signal Generator Specific Information

The different topics discussed in the following give essential information for better understanding and effective work with R&S Signal Generator equipped with options EUTRA/LTE R&S SMW-K55/-K255/-K69/-K81/-K84/-K85. The topics provide information about some specific functions of the R&S Signal Generator.

## 5.1 Conflict Handling in the R&S Signal Generator

In 3GPP TS 36.211 [3], physical signals and physical channels are defined for the EUTRA/LTE system. Therefore the available resources in the time-frequency domain are shared by the different signals and different kinds of allocations (comparable to the different channel types in the 3GPP FDD mode).

### 5.1.1 Downlink

In the current R&S Signal Generator release, the following types of signals and channels for the downlink are supported:

- Reference Signal
- Primary Synchronization Signal (P-SYNC)
- Secondary Synchronization Signal (S-SYNC)
- Physical Broadcast Channel (PBCH)
- Physical Downlink Control Channel (PDCCH), including PCFICH and PHICH
- Physical Downlink Shared Channel (PDSCH)
- Reserved channel

Due to the concept of the R&S Signal Generator different situations may appear that need clarification. If several signals and/or channels (of the same or different type) partly share the same resources, a decision has to be made what bits are really mapped to the affected subcarriers. The general rule here is that the signal or channel with the higher priority is transmitted completely while the affected subcarriers are stamped out of the lower priority signal or channel respectively. Note that this reduces the number of available physical bits of a signal/channel.

The actual size of a certain allocation is displayed in the column Physical Bits of the resource allocation table.

The following picture shows the priorities of the different signal and channel types.

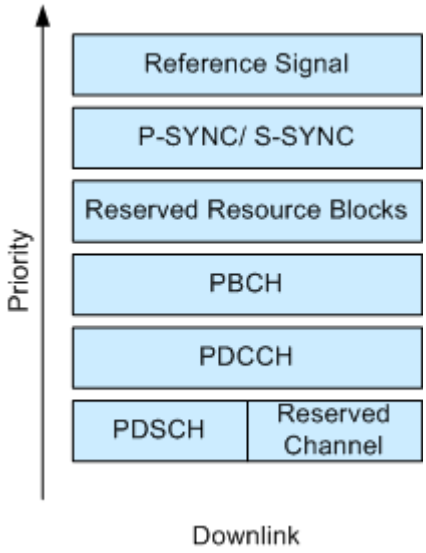



*Fig. 5-1: Priority of different allocations, channels and signals in the downlink*

- Overlapping of signals and/or channels with different priorities
  In case signals and/or channels (e.g. P-SYNC and PDSCH) of different priorities overlap, no conflict is displayed in the resource allocation table, as the signal/channel with the higher priority is transmitted completely.
- Overlapping of allocations with the same priority
  If different allocations of the same priority are overlapping, the one with the lower allocation index (i.e. which comes first) in the resource allocation table is treated with higher priority. In this case the reduced allocation is marked in the conflict column of the resource allocation table.

There is no way to configure a signal with overlapping reference signal and P-SYNC/S-SYNC.

If PRS and MBSFN is configured to be in the same subframe, MBSFN is skipped and PRS is transmitted solely.

If a PDSCH is configured to overlap partially with the PRS bandwidth in a PRS subframe, the PRS in these resource blocks are skipped then (see example "Overlapping PDSCH, PRS and MBSFN" on page 139).

### 5.1.2 Uplink

In the uplink implementation of the R&S Signal Generator it is possible to configure different user equipments (UEs) to use the same physical resources. The signals of the different UEs are simply added, but nevertheless a conflict is indicated in the resource allocation table.

Although a conflict is also displayed if the PUSCH and PUCCH allocations of one UE are overlapping, the signals of both allocations are added. However, a conflict can occur between the sounding reference signal of a certain UE and the PUSCH of another UE.

### 5.1.3 DCI Conflict Handling

The R&S Signal Generator allows you to configure multiple scheduling messages with their corresponding PDCCHs per subframe. Using the DCI table in the chapter 7.11, "DL Frame Configuration Settings", on page 146 dialog, the position of the DCI/PDCCH inside the multiplexed bit stream can be freely configured by setting the appropriate CCE index.

Since the number of CCEs for each PDCCH may vary, the 3GPP specification TS 36.211 [3], chapter 6.8.1 defines some restriction on the aggregation of CCEs. An aggregation of eight CCEs for instance can only start on CCE numbers evenly dividable by eight. The same principle applies to the other aggregation levels. If this restriction is not fulfilled or two CCEs are overlapping, a conflict is displayed for the DCI/PDCCH with the greater number. This DCI/PDCCH is not considered by the multiplexing, i.e. it is not transmitted.

The operations "Append", "Insert", "Delete", "Up", "Down" and "Resolve Conf." are provided for flexibly configuration of valid DCIs and for resolving of conflicts.

**Example:**

In this example, the DCI table of a control channel with a total "Number of 26 Available CCEs" is configured.

The reason for the conflict displayed for the second DCI/PDCCH is that the CCEs allocated for the second DCI/PDCCH are overlapping with the CCEs used by the first one. The second DCI/PDCCH is ignored by the multiplexing.

| User | UE_ID n_RNTI | Cell Index | DCI Format | Search Space | Content | PDCCH Format | Number CCEs | CCE Index | No.Dummy CCEs | Conflict |
|---|---|---|---|---|---|---|---|---|---|---|
| User1 | 0 | 0 | 0 | Common | Config... | 2 | 4 | 0 | 4 | |
| User1 | 0 | 0 | 1A | UE-Spec | Config... | 0 | 1 | 1 | - | ● |
| User2 | 250 | 0 | 0 | UE-Spec | Config... | 1 | 2 | 16 | 8 | |
| RA_RNTI | 1 | 0 | 1C | Common | Config... | 2 | 4 | 8 | 4 | |

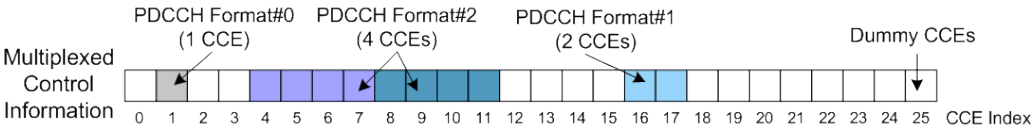
One of the ways to overcome this problem and to resolve the DCI conflict is to use the Resolve Conflicts function of the software. The built-in algorithm re-assigns automatically the CCE values depending on the configured "Search Space"; previously configured CCE values will not be maintained. The calculated signal is suitable for receiver tests that demand conflict free CCEs but have no requirements on explicit CCE values. If the conflict can not be resolved automatically, the values are left unchanged.

If however there is a requirement for CCE Indexes with explicit values, the corrections can be performed manually. In this example for example, set the CCE index of the third DCI/PDCCH to 4.

| User | UE_ID n_RNTI | Cell Index | DCI Format | Search Space | Content | PDCCH Format | Number CCEs | CCE Index | No.Dummy CCEs | Conflict |
|---|---|---|---|---|---|---|---|---|---|---|
| User1 | 0 | 0 | 0 | Common | Config... | 2 | 4 | 4 | 0 | |
| User1 | 0 | 0 | 1A | UE-Spec | Config... | 0 | 1 | 1 | 2 | |
| User2 | 250 | 0 | 0 | UE-Spec | Config... | 1 | 2 | 16 | 8 | |
| RA_RNTI | 1 | 0 | 1C | Common | Config... | 2 | 4 | 8 | 4 | |

Now the CCEs used by the two subsequent DCIs/PDCCHs are not overlapping and the two DCIs/PDCCHS are configured to be transmitted consecutive, i.e. there is no gap between them ("No. Dummy CCEs" = 0).

The figure below shows the resulting PDCCH after multiplexing for this example.




If "Activate Carrier Aggregation > ON", the parameter DCI Table determines the component carrier the corresponding User is mapped to. For this reason, there is no DCI conflict, if in the example above the second DCI belongs to a User enabled on an SCell.

| User | UE_ID n_RNTI | Cell Index | DCI Format | Search Space | Content | PDCCH Format | Number CCEs | CCE Index | No.Dummy CCEs | Conflict |
|---|---|---|---|---|---|---|---|---|---|---|
| User1 | 0 | 0 | 0 | Common | Config... | 2 | 4 | 0 | 4 | |
| User1 | 0 | 1 | 1A | UE-Spec | Config... | 0 | 1 | 1 | 24 | |
| User2 | 250 | 0 | 0 | UE-Spec | Config... | 1 | 2 | 16 | 8 | |
| RA_RNTI | 1 | 0 | 1C | Common | Config... | 2 | 4 | 8 | 4 | |

## 5.2 Subframes Handling in the R&S Signal Generator

In the following the subframes handling concept and implementation in the R&S Signal Generator is explained.

### 5.2.1 Copy/Paste Subframe

In order to simplify the configuration of the EUTRA/LTE signal the user has the possibility to copy and paste settings from one subframe to another. Note that beside the cyclic prefix length only the structure of PDCCH and PDSCH allocations for the downlink and the PUSCH and PUCCH allocations for the uplink are copied. P-SYNC/S-SYNC, PBCH, PRACH and Sounding Reference Signals are not considered. This is due to the fact that the P-SYNC/S-SYNC are configured globally in the "General DL Settings" menu and can therefore not be overwritten in the "Frame Configuration - DL" menu; the PBCH can only be configured in subframe 0 and can therefore also not be overwritten. Respectively, the Sounding Reference Signal and the PRACH are configured individually for each user equipment in the User Equipment Configuration dialog.

Copying allocations from a subframe without P-SYNC/S-SYNC/PBCH to one with P-SYNC/S-SYNC/PBCH and vice versa might lead to conflict situations. In this case the rules discussed in chapter 5.1, "Conflict Handling in the R&S Signal Generator", on page 51 become effective.

However, configurations can occur where in different subframes allocations which are identical by means of scheduled resource blocks have a different amount of physical bits available, due to the out stamping of overlapping subcarriers.

### 5.2.2 Number of Configurable Subframes

Another possibility to simplify the configuration of the EUTRA/LTE signal for the user is to configure only a small number of subframes manually and then let the EUTRA/LTE fill the remaining signal periodically with the configured subframes. Internally the Copy/Paste Subframe functionality is used, so again only the structure of the PDCCH/PDSCH in downlink and the PUCCH/PUSCH in uplink are copied, but no P-SYNC/S-SYNC/PBCH/PRACH or sounding reference signals.

### 5.2.3 Four Configurable Frames in Uplink and Downlink Direction

The R&S Signal Generator supports the configuration of up to four frames in uplink and downlink direction. However, there is a limitation for the maximum number of the real configurable subframes in this four frames depending on the transmission direction and several other parameters.

#### 5.2.3.1 Uplink Direction

The maximum number of configurable subframes changes as function of the parameters in the following way:

- For **Disabled** Realtime Feedback
  - In FDD duplexing mode, the maximum number of configurable subframes is 40 subframes, where the maximum number of 40 subframes is available for sequence lengths of at least four frames
  - In a TDD frame only the uplink subframes are enabled for configuration. The maximum number of the configurable subframes is determined by the selected "UL/DL Configuration" and the possible values are listed in the corresponding column in the cross-reference table below.
- For **Enabled** Realtime Feedback, the maximum number of configurable uplink subframes for the PUSCH channel of the first user equipment (UE 1) is determined by the "Number of HARQ Processes", that itself also depends on the duplexing mode and the UL/DL configuration.
  For an overview of the possible values, see the corresponding column in the cross-reference table 5-1.

The current subframe to be configured is selected by means of the parameter Subframe.

The configurable range ("Number of configurable uplink subframes") can be configured independently for the individual user equipments. Furthermore, for Release 10 user equipments, the range can be configured independently for the PUCCH and the PUSCH channel.

Subframes behind the configurable range of the corresponding UE or channel are displayed as read-only.

*Table 5-1: Value range for the parameter Number of Configurable UL Subframes*

| "Duplexing mode" | "UL/DL Configuration" | UL subframes in the first four frames (see figure 3-6) | Number of UL subframes per frame | Number of HARQ processes | Value range for the parameter "Number of Configurable UL Subframes" | |
|---|---|---|---|---|---|---|
| | | | | | disabled realtime feedback | enabled realtime feedback |
| TDD | 0 | 2, 3, 4, 7, 8, 9,<br>12, 13, 14, 17, 18, 19,<br>22, 23, 24, 27, 28, 29,<br>32, 33, 34, 37, 38, 39 | 6 | 7 | 1 .. 24 | 1, 7 |
| | 1 | 2, 3, 7, 8,<br>12, 13, 17, 18,<br>22, 23, 27, 28,<br>32, 33, 37, 38 | 4 | 4 | 1 .. 16 | 1, 2, 4 |

| "Duplexing mode" | "UL/DL Configuration" | UL subframes in the first four frames (see figure 3-6) | Number of UL subframes per frame | Number of HARQ processes | Value range for the parameter "Number of Configurable UL Subframes" | |
|---|---|---|---|---|---|---|
| | | | | | disabled realtime feedback | enabled realtime feedback |
| | 2 | 2, 7,<br>12, 17,<br>22, 27,<br>32, 37 | 2 | 2 | 1 .. 8 | 1, 2 |
| | 3 | 2, 3, 4,<br>12, 13, 14,<br>22, 23, 24,<br>32, 33, 34 | 3 | 3 | 1 .. 12 | 1, 3 |
| | 4 | 2, 3,<br>12, 13,<br>22, 23,<br>32, 33 | 2 | 2 | 1 .. 8 | 1, 2 |
| | 5 | 2, 12, 22, 32 | 1 | 1 | 1 .. 4 | 1 |
| | 6 | 2, 3, 4, 7, 8,<br>12, 13, 14, 17, 18,<br>22, 23, 24, 27, 28,<br>32, 33, 34, 37, 38 | 5 | 6 | 1 .. 20 | 1, 2, 3, 6 |
| FDD | - | 0 .. 39 | 10 | 8 | 1 .. 40 | 1, 2, 4 ,8 |

**Example:**

- For selected FDD duplexing mode, disabled realtime feedback and **Number of Configurable Uplink Subframes** set to 13, "Subframes" 0 ... 12 are configurable. Subframes from 13 on are readonly.
- For selected TDD duplexing mode, "UL/DL Configuration = 6" and disabled realtime feedback the "Number of Configurable Uplink Subframes" is in the range 1 .. 20 (see table 5-1).
  If for instance the "Number of Configurable Uplink Subframes" is set to 10, the following 10 subframes are configurable: 2,3,4,7,8,12,13,14,17,18.
  These are the first 10 uplink subframes. All other subframes (downlink subframes, special subframes and subframes from 19 on) are readonly.
- For selected TDD duplexing mode, "UL/DL Configuration = 6" and enabled realtime feedback, up to 6 HARQ processes can be configured and therefore1, 2, 3 or 6 configurable uplink subframes are available for the PUSCH channel of the first user equipment.
  If for instance the "Number of Configurable Uplink Subframes" is set to 6, the following 6 subframes are configurable: 2,3,4,7,8,12.
  These are the first 6 uplink subframes. All other subframes (downlink subframes, special subframes and subframes from 13 on) are readonly.

#### 5.2.3.2 Downlink Direction

In downlink direction, the maximum number of the real configurable subframes depends on the selected General Settings mode (TDD or FDD), TDD Frame Structure Settings, whereas in downlink direction the special subframes are also configurable (in addition to the downlink subframes).

Since the realtime feedback functionality is an uplink feature, the maximal number of the configurable subframes in downlink direction is not additionally limited by the number of HARQ processes.

The subframe to be configured is selected by means of the parameter Subframe Selection. The maximum value for this parameter is then determined by the number of the last configurable subframe (see also table 5-2).

***Table 5-2: Value range for the parameter Number of Configurable DL Subframes***

| Duplexing mode | UL/DL Configuration | DL and Special subframes in the first four frames (see figure 3-6) | Number of DL and special subframes per frame | Value range for the parameter Number of Configurable DL Subframes |
|---|---|---|---|---|
| TDD | 0 | 0, 1, 5, 6,<br>10, 11, 15, 16,<br>20, 21, 25, 26,<br>30, 31, 35, 36 | 4 | 1 .. 16 |
| | 1 | 0, 1, 4, 5, 6, 9<br>10, 11, 14, 15, 16, 19<br>20, 21, 24, 25, 26, 29,<br>30, 31, 34, 35, 36, 39 | 6 | 1 .. 24 |

| Duplexing mode | UL/DL Configuration | DL and Special subframes in the first four frames (see figure 3-6) | Number of DL and special subframes per frame | Value range for the parameter Number of Configurable DL Subframes |
|---|---|---|---|---|
| | 2 | 0, 1, 3, 4, 5, 6, 8, 9<br>10, 11, 13, 14, 15, 16, 18, 19<br>20, 21, 23, 24, 25, 26, 28, 29,<br>30, 31, 33, 34, 35, 36, 38, 39 | 8 | 1 .. 32 |
| | 3 | 0, 1, 5, 6, 7, 8, 9<br>10, 11, 15, 16, 17, 18, 19<br>20, 21, 25, 26, 27, 28, 29,<br>30, 31, 35, 36, 37, 38, 39 | 7 | 1 .. 28 |
| | 4 | 0, 1, 4, 5, 6, 7, 8, 9<br>10, 11, 14, 15, 16, 17, 18, 19<br>20, 21, 24, 25, 26, 27, 28, 29,<br>30, 31, 34, 35, 36, 37, 38, 39 | 8 | 1 .. 32 |
| | 5 | 0, 1, 3, 4, 5, 6, 7, 8, 9<br>10, 11, 13, 14, 15, 16, 17, 18, 19<br>20, 21, 23, 24, 25, 26, 27, 28, 29,<br>30, 31, 33, 34, 35, 36, 37, 38, 39 | 9 | 1 .. 36 |
| | 6 | 0, 1, 5, 6, 9<br>10, 11, 15, 16, 19,<br>20, 21, 25, 26, 29,<br>30, 31, 35, 36, 39 | 5 | 1 .. 20 |
| FDD | - | 0 .. 39 | 10 | 1 .. 40 |

## 5.3 Power Setting

The R&S Signal Generator equipped with option Digital Standard EUTRA/LTE (R&S SMW-K55/K255) provides several possibilities to adjust the power level of the generated LTE signal as well as to adjust the relations between the power levels of the channels and signals in the LTE signal itself.

### 5.3.1 General Power Settings

The general power settings are as follows:

- Output level (Pout) of the instrument
  To adjust the value, select "Status bar > Level".

### 5.3.2 Downlink Power Settings

In downlink direction, the value displayed in the "Level" display defines the RMS level of the output signal calculated upon several frames. In the FDD duplexing mode, the displayed RMS and the PEP values are valid for the whole frame, while in TDD duplexing mode, the calculation is based only on the downlink parts of the frame, i.e. the DL sub-frames and the DwPTS (see also parameter "Power Reference" on page 269).

Additionally to the general power settings, the following settings are influencing the power of the output signal in downlink direction:

- Downlink Reference Signal Structure
- Synchronization Signal Settings, Synchronization Signal Settings
- PBCH Power and PDSCH Power
- PCFICH Settings,PHICH Settings , PDCCH Settings
- Cell Specific Settings (Cell Specific Settings) and Cell Specific Settings

All DL power configurations are set relative to each other and the absolute power level of one resource element during one sub-frame depends on the configuration during the remaining sub-frames. If for instance the PDCCH power is set to 2 dB and a certain PDSCH has a power of -3 dB, this means that the power level of the PDCCH sub-carriers is with 5 dB higher than the power level of the PDSCH sub-carriers.

The basis for the calculation of the absolute power level of the channels and the signals in DL direction is the power of one reference signal resource element. The value is displayed in the Downlink Signals dialog by means of the parameter Downlink Reference Signal Structure. Use this parameter to configure a specific absolute power of one Reference Signal's sub-carrier, like for example to set a required SNR defined for a 15kHz sub-band.

To calculate the absolute power value a single Reference Signal sub-carrier, consider the general power settings and the relative RS Power.

**Example:**

For the default setting of this firmware, the values of the related parameters are as follow:

"Level" = - 30 dB

"RS Power per RE relative to Level Display" = - 27.78 dB

The absolute power level of a single Reference Signal sub-carrier is the sum of these three values, i.e. -57.78 dBm.

If for instance the value of the PDSCH power is changed to - 3 dB, the absolute power level of a PDSCH sub-carrier calculated based on the absolute power level of a single Reference Signal is than -60.78 dBm.

### 5.3.3 Uplink Power Settings

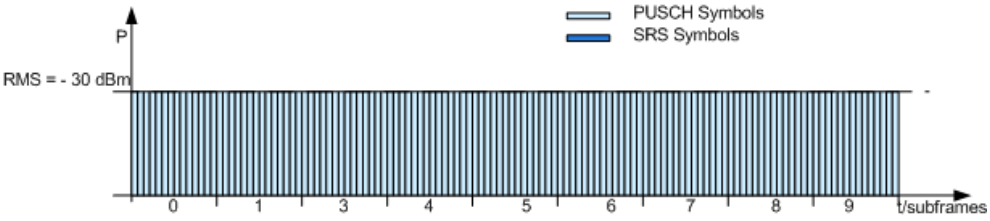
Additionally to the General Power Settings, the following settings are influencing the power of the output signal in uplink direction:

- Power Reference

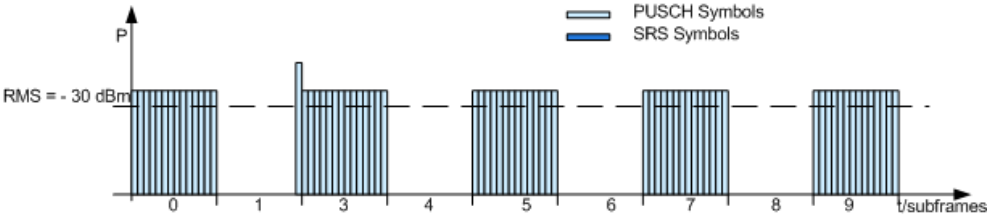
- Power factors for PUSCH/PUCCH/PRACH/SRS
- DRMS Power Offset (available for PUSCH and PUCCH)
- UE Power

While generating an uplink signal, the power displayed in the "Level" display defines the current RMS level at the output. The RMS and PEP values however are calculated based upon different parts of the signal depending on the selected Power Reference in the Filter/Clipping/Power Settings dialog.

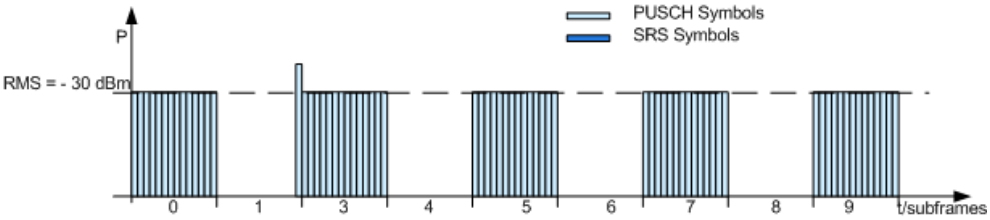
- "Power Reference" = "Frame RMS Power" (UL FDD) or "UL Part of Frame RMS Power" (UL TDD)
  In the FDD duplexing mode, the displayed RMS and the PEP values ("Level" and "PEP") are valid for the whole frame, while in TDD duplexing mode, the calculation is based only on the uplink parts of the frame, i.e. the UL subframes and the UpPTS.




  **Note:** The absolute power of a single subframe depends also on the signal within of the remaining subframes.




- "Power Reference" = "UE Burst RMS Power" (UL FDD and UL TDD)
  The displayed "Level" and "PEP" values are measured only for a certain burst of a single UE. See the description of the parameter Power Reference for description of the decision algorithm and how the reference bursts are selected.




  Use this mode to simplify the setting up of the SNR required for the test cases defined in the 3GPP specification TS 36.141, in case the PUSCH is not transmitted in every subframe.

# 6 Realtime Feedback for Closed Loop BS Tests

The EUTRA/LTE uplink realtime feedback functionality requires the additional option R&S SMW-K69 Closed Loop BS Tests. This option extends the EUTRA/LTE option R&S SMW-K55 with the possibility to perform closed loop performance tests with feedback as defined in 3GPP TS 36.141, chapter 8.

The Realtime Feedback Configuration is enabled only for UE1 in instruments equipped with the option R&S SMW-K69.

This feature allows the DUT to dynamically control the transmission of channel coded data packets. By means of the feedback sent from the DUT to the R&S SMW, ACK/NACK signaling (HARQ feedback) and timing adjustment is possible, similar to the feedback sent from a base station to a user equipment by means of the air interface (PDCCH/ PHICH channels).

By means of ACK/NACK commands, the DUT can control the channel coding configuration (i.e. the redundancy version) of the transmitted PUSCH packets in real time. The behavior of the R&S SMW is similar to the behavior of the HARQ entity / the HARQ processes of a real user equipment (according to 3GPP TS 36.321).

By means of timing adjustment/timing advance commands, the DUT can request time shifts of the uplink signal generated by the R&S SMW and thus causing a delay or advance of the uplink signal in real time (according to 3GPP TS 36.213).

## 6.1 Exemplary Testing Scenario

The testing specifications in TS 36.141, chapter 8, specifies the test setups. For example, the test "Performance requirements for UL timing adjustment" (TS 36.141, section 8.2.2) can be setup according to the figure 6-1.

One single R&S SMW is sufficient.

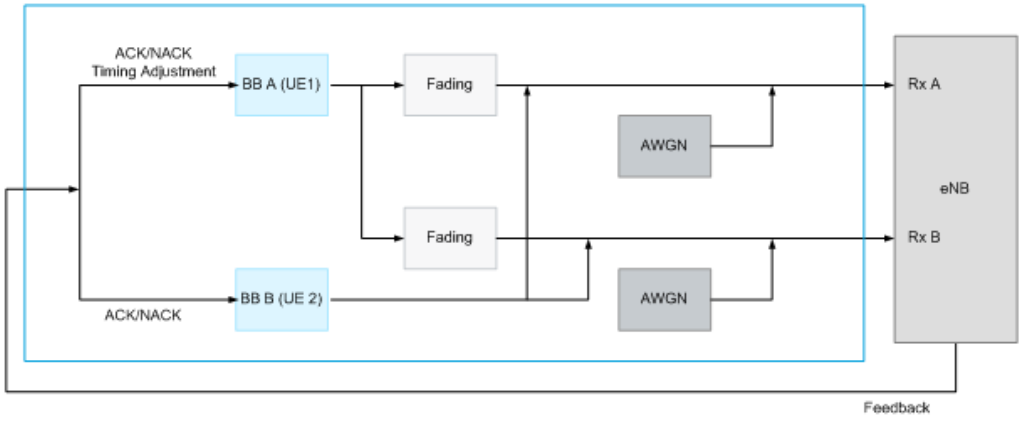
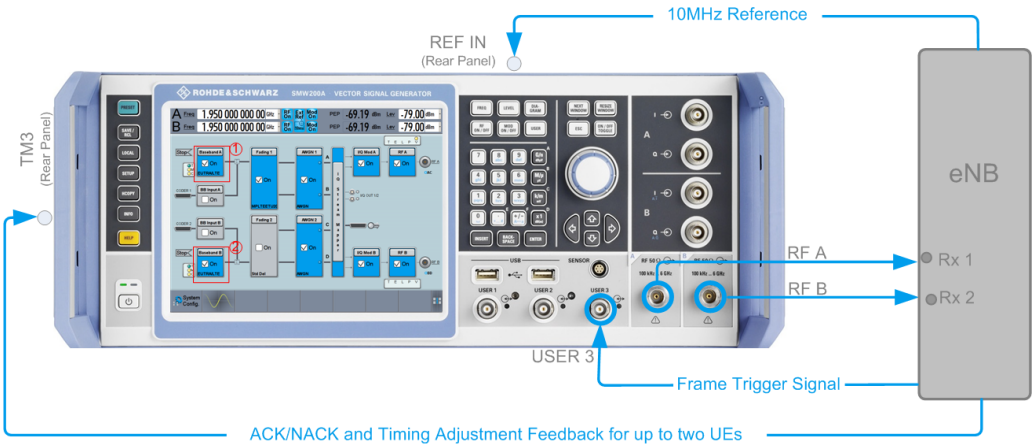



*Fig. 6-1: Exemplary test scenario*

If your instrument is equipped with internal fading and AWGN generators, no more test equipment is required to perform the performance requirement test measurements. The simulation of the propagation conditions according to the specified test scenarios is achieved by selecting the required fading profiles and an additive white Gaussian noise. For more detailed description about the available fading profiles and how to work with the fading simulator, refer to the description "Fading Simulator".

The feedback is transmitted from the DUT to the R&S SMW by means of the serial protocol (serial mode). The test setup requires a 10 MHz external reference line between the DUT and R&S SMW, and a common trigger source (downlink timing) for synchronization of the R&S SMW and the DUT.




1 = Baseband A generates the signal of the moving UE
2 = Baseband B generates the signal of the stationary UE

## 6.2 Feedback Modes

The test setups for performance verification require a feedback line from the DUT (base station) to the signal source. The R&S SMW provides two interfaces for the necessary feedback line, a binary and a serial one, and two connectors, the local T/M 3 connector and the global USER 6 connector. Both interfaces are suitable for HARQ feedback tests; for testing of an UL timing adjustment however, a connection over a serial feedback line has to be established.

**Routing and enabling feedback signal**

The R&S SMW uses a flexible signal to connector mapping concept. In the default instrument state, the local T/M 3 and the globally shared USER 6 connector are not configured as inputs of the feedback and the baseband feedback signal.

To route and enable a feedback signal, perform the following *general steps*:

- Define the connector type, "Global" or "Local", the feedback signal is expected at.
- Use the Local and Global Connector Settings and define:
  - "Connector > Direction > Input".
  - "Connector > Signal > Feedback" to route and map the corresponding signal.
- Connect the feedback line to the configured connector.

In this firmware version, the "Global" connector is disabled.

The input impedance of the connectors and the low/high threshold voltage are configurable parameters. Use the Local and Global Connector Settings dialog and adjust the parameters "Threshold Trigger/Control Input" and "Impedance Trigger/Control Input" as required.

### 6.2.1 Binary Mode

A binary line carries the information in form of a high and low voltage level and is sufficient for the transmission of ACK and NACK commands. In the binary mode, the instrument detects the voltage level at the input connector and depending on the configuration (see parameter "ACK Definition" on page 233), the input level is interpreted as ACK or NACK.

### 6.2.2 Serial Mode

The serial line carries the information in form of commands where a command consists of 16 data bits (D0..D15), 1 start bit (low level) and 1 stop bit (high level). No parity bit has to be transmitted. The least significant bit (D0) is transmitted first.

The feedback commands are transmitted with a "Serial Rate" of 115.2 kbps, 1.6 Mbps or 1.92 Mbps. Between two consecutive commands or before the very first command, the line has to be held on high level (idle).

### 6.2.3 Serial 3x8 Mode

In this mode, a command does not consist of one singular serial packet, but consists of three serial packets.

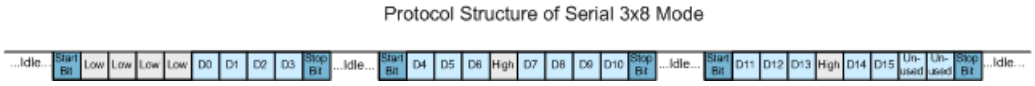



***Fig. 6-2: Structure of one feedback command in "Serial 3x8" mode***

Each of the three packets consists of one start bit (low level), eight serial bits and one stop bit (high level). No parity bits have to be transmitted. The sixteen data bits D0 ... D15 are distributed among the three times eight serial bits according to figure. The remaining serial bits must have specified low or high levels according to the figure for synchronization purposes.

The three serial packets of the feedback commands are transmitted with a "Serial Rate" of 115.2 kbps, 1.6 Mbps or 1.92 Mbps. Between two consecutive packets or between two consecutive commands or before the very first command, the line has to be held on high level (idle).

### 6.2.4 Structure of a serial and 3x8 serial feedback command

The table 6-1 shows the structure and the meaning of the 16 data bits (D0..D15) in a feedback command, where D15 refers to the most significant bit.

***Table 6-1: Structure of one feedback command***

| D15-D14 | D13-D11 | D10-D0 |
|---|---|---|
| BB Selector | Message Type Selector | Message Bits |

- The **BB Selector** (D15-D14) determines for which of the baseband blocks the feedback command is for.
  The R&S SMW can be equipped with up to two baseband blocks, where each baseband block can simulate one UE with closed loop feedback. The BB selector takes value in the range from 0 to 3 and can be arbitrarily assigned to each baseband block. Therefore, you can send different feedback commands to different baseband blocks over one feedback line.
  Alternatively, several baseband blocks that use the same BB selector can share the feedback commands, even if these baseband blocks are in different instruments connected to the same feedback line.
- The **Message Type Selector** (D13-D11) determines the message type and the command that is signaled (see table 6-2).

***Table 6-2: Message types***

| Message Type Selector | Message Type | Description |
|---|---|---|
| 0 | HARQ Feedback Auto | Carries only ACK/NACK feedback.<br>The redundancy version (RV) to be used in the next PUSCH transmission of the affected HARQ process is determined automatically |
| 1 | HARQ Feedback with RV request | Carries ACK/NACK feedback and a request for a specific redundancy version (RV). This RV is then applied in the next PUSCH transmission of the affected HARQ process.<br>This command causes the instrument's HARQ process logic to "jump" to the first occurrence of the requested redundancy version in the configured redundancy version sequence (according to the HARQ process description in 3GPP TS 36.321). |

| Message Type Selector | Message Type | Description |
|---|---|---|
| 2 | Timing Advance Command (Absolute) | Requests an absolute timing advance of the uplink signal |
| 3 | Timing Adjustment Command (Relative) | Requests a relative timing adjustment of the uplink signal |
| 4 | Combined HARQ Feedback Auto and Relative Timing Adjustment Command | Combination of the both commands "HARQ Feedback Auto" and the "Timing Adjustment (Relative)".<br>The instrument behaves exactly as if the HARQ feedback and the timing adjustment would be sent in two separate commands |
| 5-7 | reserved | - |

- **Message Bits** (D10-D0)
  The figure 6-3 gives an overview of the structure of the different commands and the information they carry.

| Message Type | Message Bits | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| HARQ Feedback Auto | reserved | | | | | | For FDD mode: reserved<br>For TDD mode and UL/DL configurations 1..6: reserved<br>For TDD mode and UL/DL configuration 0:<br>– 1: adjust subframe "n+7"<br>– 2: adjust subframe "n+k"<br>– 0 or 3: adjust both subframes "n+k" and "n+7" | | 0: NACK<br>1: ACK | reserved | |
| HARQ Feedback with RV request | | | | | | | | | | Requested redundancy version (RV).<br>D1 is MSB, D0 is LSB | |
| Timing Advance Command (Absolute) | 11-bit timing advance command $T_A$ according to TS 36.213, chapter 4.2.3.<br>The D10 is MSB and D0 is the LSB. | | | | | | | | | | |
| Timing Adjustment Command (Relative) | reserved | | | | | | 6-bit timing adjustment command $T_A$ according to TS 36.213, chapter 4.2.3.<br>– $T_A$ = 31 means no adjustment<br>– $T_A$ > 31 means an increasing advance of the uplink signal<br>– $T_A$ < 31 means the advance of the uplink signal is decreased by delaying the signal<br>The D5 is MSB, the D0 is LSB. | | | | |
| Combined HARQ Feedback Auto and Relative Timing Adjustment Command | 6-bit timing adjustment command $T_A$ according to TS 36.213, chapter 4.2.3.<br>– $T_A$ = 31 means no adjustment<br>– $T_A$ > 31 means an increasing advance of the uplink signal<br>– $T_A$ < 31 means the advance of the uplink signal is decreased by delaying the signal<br>The D10 is MSB, the D5 is LSB. | | | | | | For FDD mode: reserved<br>For TDD mode and UL/DL configurations 1..6: reserved<br>For TDD mode and UL/DL configuration 0:<br>– 1: adjust subframe "n+7"<br>– 2: adjust subframe "n+k"<br>– 0 or 3: adjust both subframes "n+k" and "n+7" | | 0: NACK<br>1: ACK | reserved | |

***Fig. 6-3: Message bits***

**Example:**

The figure below depicts the example of a serial feedback command with the following settings:

- BB Selector = 01
- Message Type Selector = 000, i.e. HARQ Feedback Auto
- ACK/NACK bit = 1, i.e. ACK is transmitted
- Message Bits D3-D4 are reserved for FDD mode.

The least significant bit (LBS) is transmitted first.

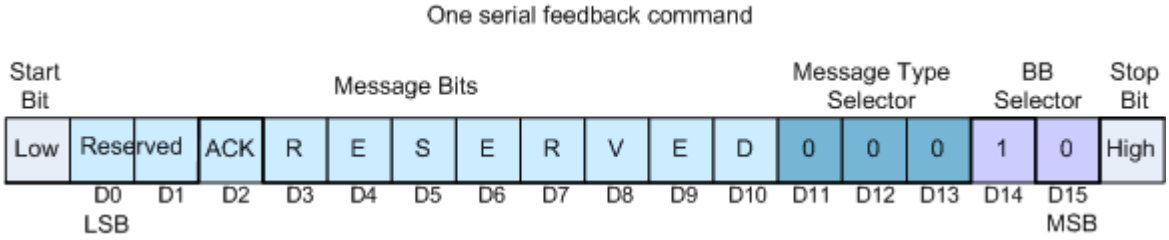



***Fig. 6-4: Example of a serial feedback command (HARQ Feedback Auto)***

# 6.3 Timing Aspects

The available number of messages per subframe in the downlink timing depends on the feedback line used. A binary feedback line allows only one feedback message per subframe in downlink timing, whereas zero, one ore several feedback messages can be sent over the serial or the serial 3x8 one.

## 6.3.1 Parameterization of the feedback timing

The parameterization of the feedback timing deppends on the "Feedback Mode" (binary, serial or serial 3x8) and the selected "Distance Mode" (3GPP or direct response).

### 6.3.1.1 Timing for binary mode with 3GPP Distance Mode, serial or serial 3x8 mode

The figure bellow illustrates the parameterization of the feedback timing. The example shows timing of feedback commands carrying the information that would be sent in a PDCCH/PHICH channel in downlink subframe n, in comparison to the downlink signal of the air interface. It is a prerequisite that the base station and the instrument are synchronized by means of a common trigger source and a 10 MHz reference line.

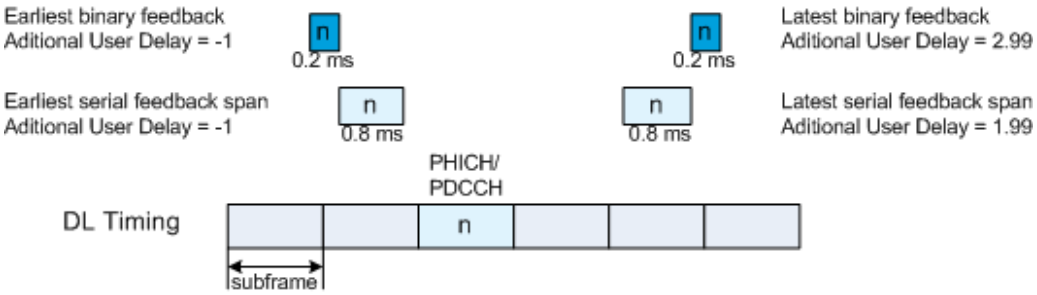



*Fig. 6-5: Parameterization of the feedback timing*

The exact timing of the feedback commands can be adjusted by the parameter Additional User Delay.

- In **binary mode**, an "Additional User Delay" of 0 means, the instrument reads the binary feedback at the point in time that coincides with the beginning of the subframe (in downlink timing), in which the respective information would be sent in the PDCCH/ PHICH channels over the air interface.
  Note that the feedback level has to be held constant from 0.1 ms before this point in time until 0.1 ms after this point in time.
  For binary mode, the additional user delay can vary between -1.00 and 2.99 subframes.
- In **serial** and **serial 3x8 mode**, an "Additional User Delay" of 0 means that all serial feedback commands that contain information which would be sent in the PDCCH/ PHICH channels in one specific subframe, have to be sent inside a 0.8 ms time span starting 0.1 ms after the beginning of this PDCCH/PHICH subframe (downlink timing) and ending 0.1 ms before the end of this PDCCH/PHICH subframe.
  For serial and serial 3x8 mode, the additional user delay can vary between -1.00 and 1.99 subframes.

#### 6.3.1.2 Maximum number of serial feedback commands

The serial feedback commands and the individual serial packets of the serial 3x8 feedback command can be transmitted asynchronously inside the serial feedback span. Technically, the instrument is able to process a maximum number of 40 serial commands in one serial feedback span, independently from the baseband selectors. For Serial Rate of 115.2 kbps, the number of commands is further limited due to their length and the low bit rate. A maximum number of 5 commands fit into the 0.8 ms serial feedback span. Up to three commands consisting each of three serial packets can be transmitted within the 0.8 ms while using the serial 3x8 feedback.

#### 6.3.1.3 Timing for binary mode with Direct Response Distance Mode

In **binary mode**, there is also another possibility for determining the uplink subframe, in which the signaled feedback has the desired effect. In this "Direct Response Distance Mode", the influenced uplink subframe is calculated from the position of the last sent uplink packet of a HARQ process (see the examle on figure 6-6).

Supposing an initial timing advance of 0, an additional user delay of 0 would mean, that the binary feedback to a specific uplink HARQ packet is expected by the instrument at the point in time that coincides with the beginning of this uplink subframe, which does not make sense. Therefore, for the "Direct Response Distance Mode", the allowed range of the parameter "Additional User Delay" starts with +1.00 subframes.

The uplink subframe in which the signaled HARQ feedback has the desired effect is the next uplink subframe corresponding to the HARQ process the feedback was for.

Note that the feedback level has to be held constant from 0.1 ms before until 0.1 ms after the point in time when the instrument expects the binary feedback.

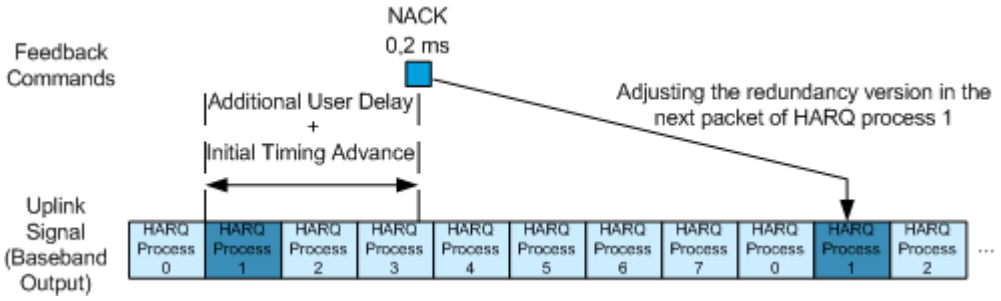



***Fig. 6-6: Timing of feedback commands in Direct Response Distance Mode (Example for FDD).***

### 6.3.2 Uplink Timing

The uplink subframe in which the signaled feedback has the desired effect is calculated from the downlink subframe number n, according to 3GPP TS 36.213, section 4.2.3 (timing adjustment/timing advance commands) and chapter 8 (HARQ feedback commands). This does not apply if binary mode with direct response distance mode is used.

The figure bellow depicts the principle of the uplink timing by means of an example of a FDD mode with 8 active HARQ processes.

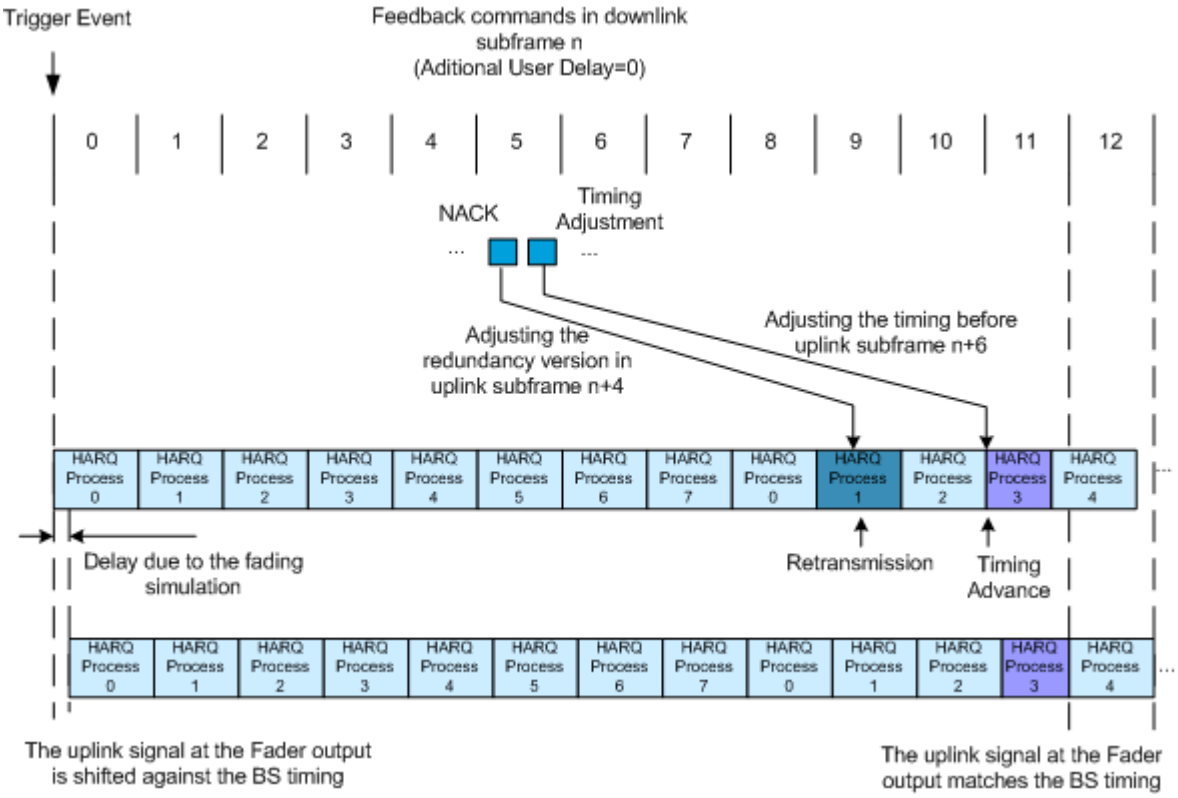



***Fig. 6-7: Timing of feedback commands for serial or serial 3x8 mode (Example for FDD).***

In FDD, due to invariant DL and UL subframe configuration and continuous DL and UL transmission, the retransmission of data occurs in a predefined time after the initial transmission. In TDD however, such a fixed relation is not possible and the time varies depending on the active UL/DL configuration.

- A **timing adjustment command** corresponding to downlink subframe **n** causes a timing adjustment of the uplink signal at the beginning of uplink subframe **n+6**.
- A HARQ feedback command corresponding to downlink subframe n causes an adjustment of the redundancy version in:
  - uplink subframe **n+4**, if FDD is used without subframe bundling operation and if there is a PUSCH transmission scheduled in uplink subframe **n+4**.
  - uplink subframe **n+k**, with **k** given in table 8-2 of TS 36.213, if TDD is used with UL/DL configurations 1 to 6 without subframe bundling operation and if there is a PUSCH transmission scheduled in uplink subframe **n+k**
  - uplink subframe determined by the bits D4-D3 of the HARQ feedback command, "HARQ Feedback Auto" or "HARQ Feedback with RV request" (see table 6-2), in case of TDD transmission with UL/DL configuration 0.
  - Note that for binary HARQ feedback, both the subframes **n+k** and **n+7** are modified, in case of TDD transmission with UL/DL configuration 0.

#### 6.3.2.1 General timing rules

The first HARQ feedback recognized by the instrument after triggering is the feedback responding to the first uplink PUSCH transmission. For example, if a PUSCH is scheduled in uplink subframe 0 and if FDD without subframe bundling is used, the first HARQ feedback recognized by the instrument is the one affecting uplink subframe 8.

If no HARQ feedback command is received for a specific HARQ process in serial mode, the instrument behaves as if NACK was signaled in a "HARQ Feedback Auto" command. If there is a conflict between several HARQ feedback commands (because they would affect the same uplink PUSCH transmission), only the last received HARQ feedback command is considered.

The first timing advance or timing adjustment command that is recognized by the instrument after triggering is the one causing a timing adjustment at the beginning of uplink subframe 8.

If no timing advance or timing adjustment command is received, then no timing adjustment is applied, (i.e. the timing advance in subframe n+6 will not be modified). If there is a conflict between several timing advance or timing adjustment commands (because they would affect the same uplink subframe), only the last received timing advance / adjustment command is considered.

If the serial or serial 3x8 mode is used, the serial line has to be held idle (high) during downlink subframe 0.

## 6.4 Avoiding Synchronization Problems

In order to be able to successfully decode the transmitted uplink packets, both the signal generator and the device under test have to keep track of the redundancy versions used in the HARQ processes, because the device under test has to know which redundancy version to expect at a certain point in time (subframe). Using the Assume ACK until first received ACK command functionality may be necessary especially if the generator is triggered by a normal frame marker of the device under test (DUT) and if the device under test already is expecting uplink transmissions before the generator is triggered.

**Examples**

Consider the following examples:

- "Redundancy Version Sequence" = 0,2,3,1
- "Maximum Number of Transmissions" = 4
- One HARQ process is shown

The device under test already is expecting uplink transmissions before the generator is triggered. But as no uplink transmissions take place before the generator starts its signal output, the device under test will not be able to successfully decode packets and therefore will expect retransmissions with different redundancy versions. After triggering the generator by a frame marker, the following situation occurs, if - for example - the DUT expects RV 3 after the generator was triggered.

**Example: Disabled parameter "Assume ACK until first received ACK command"**

The following table shows the situation after triggering the generator if the parameter "Assume ACK until first received ACK command" is disabled.

| | | |
|---|---|---|
| The generator schedules a new transmission with RV 0. | The DUT expects a retransmission with RV 3. | The DUT sends a NACK to the generator. |
| The generator received NACK and schedules a retransmission with RV 2. | The DUT expects a retransmission with RV 1. | The DUT sends a NACK to the generator. |
| The generator received NACK and schedules a retransmission with RV 3. | The DUT reached the maximum number of transmissions and expects a new transmission with RV 0. | The DUT sends a NACK to the generator. |
| The generator received NACK and schedules a retransmission with RV 1. | The DUT expects a retransmission with RV 2. | The DUT sends a NACK to the generator. |
| The generator reached the maximum number of transmissions and schedules a new transmission with RV 0. | The DUT expects a retransmission with RV 3. | The DUT sends a NACK to the generator. |

The generator and the DUT would keep on being out of synchronization.

**Example: Enabled parameter "Assume ACK until first received ACK command"**

This situation described in the first example does not occur if the generator is triggered by the device under test at a point in time when the DUT expects new transmissions (e.g. by a special marker indicating this). However, if only a frame marker is available from the DUT, the "Assume ACK until first received ACK command" functionality can be enabled, and the above example changes.

| | | |
|---|---|---|
| The generator schedules a new transmission with RV 0. | The DUT expects a retransmission with RV 3. | The DUT sends a NACK to the generator. |
| The generator ignores the NACK and schedules a new transmission with RV 0. | The DUT expects a retransmission with RV 1. | The DUT sends a NACK to the generator. |
| The generator ignores the NACK and schedules a new transmission with RV 0. | The DUT reached the maximum number of transmissions and expects a new transmission with RV 0. | The DUT sends an ACK to the generator. |
| The generator received ACK and schedules a new transmission with RV 0. | The DUT expects a new transmission with RV 0. | The DUT sends an ACK to the generator. |
| The generator received ACK and schedules a new transmission with RV 0. | The DUT expects a new transmission with RV 0. | The DUT sends an ACK to the generator. |

Now the generator and the DUT are synchronized.

## 6.5 Limitation

Although an arbitrary data source can be selected, the used user data before the channel coding is the same in all subframes for all HARQ processes and for all transmissions.

If for instance a Transport Block Size of 47520 is configured and the Data Source is set to PN9, then the first 47520 bits of the PN9 sequence are used as an input for all HARQ processes (even after an ACK), regardless of the performed transmission. However, since different redundancy versions are applied during the channel coding, the bit stream at the output of the channel coder is different for the different retransmissions.

# 7 EUTRA/LTE Configuration and Settings

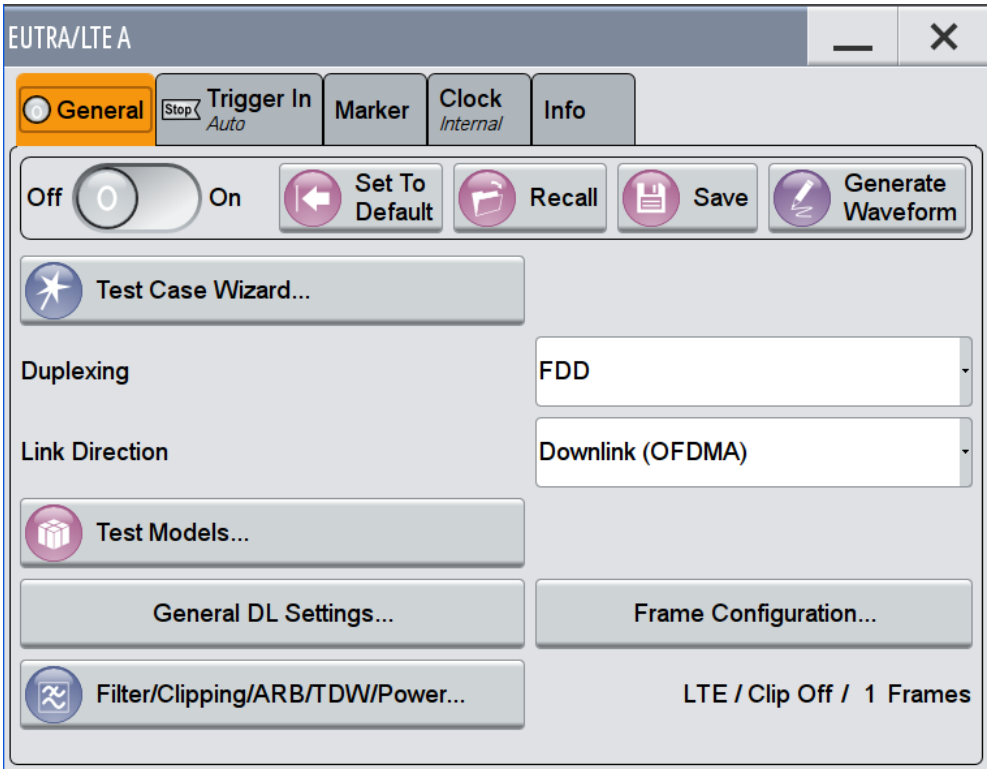
► To access the EUTRA/LTE settings, select "Baseband >EUTRA/LTE ".

The remote commands required to define these settings are described in chapter 9, "Remote-Control Commands", on page 368.


- General Settings....75
- Trigger Settings....79
- Marker Settings....85
- Clock Settings....87
- Local and Global Connector Settings....89
- Local and Global Connector Settings....89
- Info Dialog....89
- LTE Logfile Generation....90
- Test Setups/Models....105
- General DL Settings / General TDD DL Settings....106
- DL Frame Configuration Settings....146
- Enhanced PBCH, PDSCH and PMCH Settings....188
- Antenna Port Mapping Settings....197
- General UL Settings....202
- UL Frame Configuration Settings....215
- User Equipment Configuration....224
- Enhanced PUSCH Settings....250
- Enhanced PUCCH Settings....256
- TDD Timeplan....260
- Filter/Clipping/Power Settings....262


## 7.1 General Settings

► To access this dialog, select "Baseband > EUTRA/LTE > General".




This dialog comprises the standard general settings, to the default and the "Save/Recall" settings, as well as setting for defining the link direction or the used duplexing mode and access to dialogs with further settings. The choice of link direction determines which parameters are available.

Provided are the following settings:

**State**
Enables/disables the EUTRA/LTE standard.

Enabling this standard disables all the other digital standards and digital modulation modes in the same baseband.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:STATe` on page 369

**Set to Default**
Loads the default settings. The values of the main parameters are listed in the following table.

| Parameter | Values |
|---|---|
| Duplexing | FDD |
| Link Direction | Downlink (OFDMA) |
| Sequence Length | 1 Frame |
| DL Channel Bandwidth | 10 MHz |

| Parameter | Values |
|---|---|
| Physical Resource Block Bandwidth | 12 * 15 kHz |
| Number Of Resource Blocks per Slot | 50 |
| Occupied Bandwidth /MHz | 9.015 |
| Sampling Rate /MHz | 15.360 |
| FFT Size | 1024 |
| Cell ID | 0 |
| Cyclic Prefix | Normal |
| PHICH Duration | Normal |
| Global MIMO Configuration | 1 TxAntenna |
| Simulated Antenna | Antenna 1 |

Remote command:
`[:SOURce<hw>]:BB:EUTRa:PRESet` on page 370

**Save/Recall**
Accesses the "Save/Recall" dialog, i.e. the standard instrument function for storing and recalling the complete dialog related settings in a file. The provided navigation possibilities in the dialog are self-explanatory.

The file name and the directory it is stored in are user-definable; the file extension is however predefined.

See also, chapter "File and Data Management" in the R&S SMW User Manual.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:SETTing:CATalog` on page 370
`[:SOURce<hw>]:BB:EUTRa:SETTing:LOAD` on page 371
`[:SOURce<hw>]:BB:EUTRa:SETTing:STORe` on page 371
`[:SOURce<hw>]:BB:EUTRa:SETTing:DEL` on page 371

**Generate Waveform File**
With enabled signal generation, triggers the instrument to store the current settings as an ARB signal in a waveform file. Waveform files can be further processed by the ARB and/or as a multi carrier or a multi segment signal.

The file name and the directory it is stored in are user-definable; the predefined file extension for waveform files is `*.wv`.

**Note:** For enabled Realtime Feedback (see chapter 7.16.3, "Realtime Feedback Configuration Settings", on page 230), the waveform file is generated as if this functionality is disabled.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:WAVeform:CREate` on page 372

**Test Case Wizard**
Accesses the "Test Case Wizard"dialog (see chapter 8, "Test Case Wizard", on page 271).

**Logfile Generation**
Accesses the dialog for configuring the settings for generation of logfiles (see chapter 7.8, "LTE Logfile Generation", on page 90).

**Note:** Logfile generation requires the additional option R&S SMW-K81.

**Duplexing**
Selects the duplexing mode. The duplexing mode determines how the uplink and downlink signals are separated.

"TDD" In TDD mode, the same frequency is used for both directions of transmission (uplink and downlink). With one baseband, either only downlink or only uplink can be generated.

"FDD" In FDD mode, different frequencies are used for downlink and uplink directions.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DUPLexing` on page 369

**Link Direction**
Selects the transmission direction.

"Downlink (OFDMA)" The transmission direction selected is base station to user equipment. The signal corresponds to that of a base station. For the downlink, the physical layer mode is always set to OFDMA.

"Uplink (SC-FDMA)" The transmission direction selected is user equipment to base station. The signal corresponds to that of a user equipment. For the uplink, the physical layer mode is always set to SC-FDMA.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:LINK` on page 370

**Test Models**
Accesses a dialog for selecting one of the test models defined in the 3GPP specification TS 36.141 and the self-defined test setups.

For description of the available settings, refer to chapter 7.9, "Test Setups/Models", on page 105.

Remote command:
n.a.

**General DL Settings…/ General UL Settings…**
Accesses the "General DL Settings / General UL Settings" dialog for configuring the EUTRA/LTE system.

For description of the available settings, refer to chapter 7.10, "General DL Settings / General TDD DL Settings", on page 106 and chapter 7.14, "General UL Settings", on page 202 respectively.

Remote command:
n.a.

**Frame Configuration…**
Accesses the "Frame Configuration" dialog for configuring the allocation of the resource blocks to the different users, as well as the configuration of the users.

The available settings depend on the selected link direction. For description, refer to chapter 7.11, "DL Frame Configuration Settings", on page 146 and chapter 7.15, "UL Frame Configuration Settings", on page 215 respectively.

Remote command:
n.a.

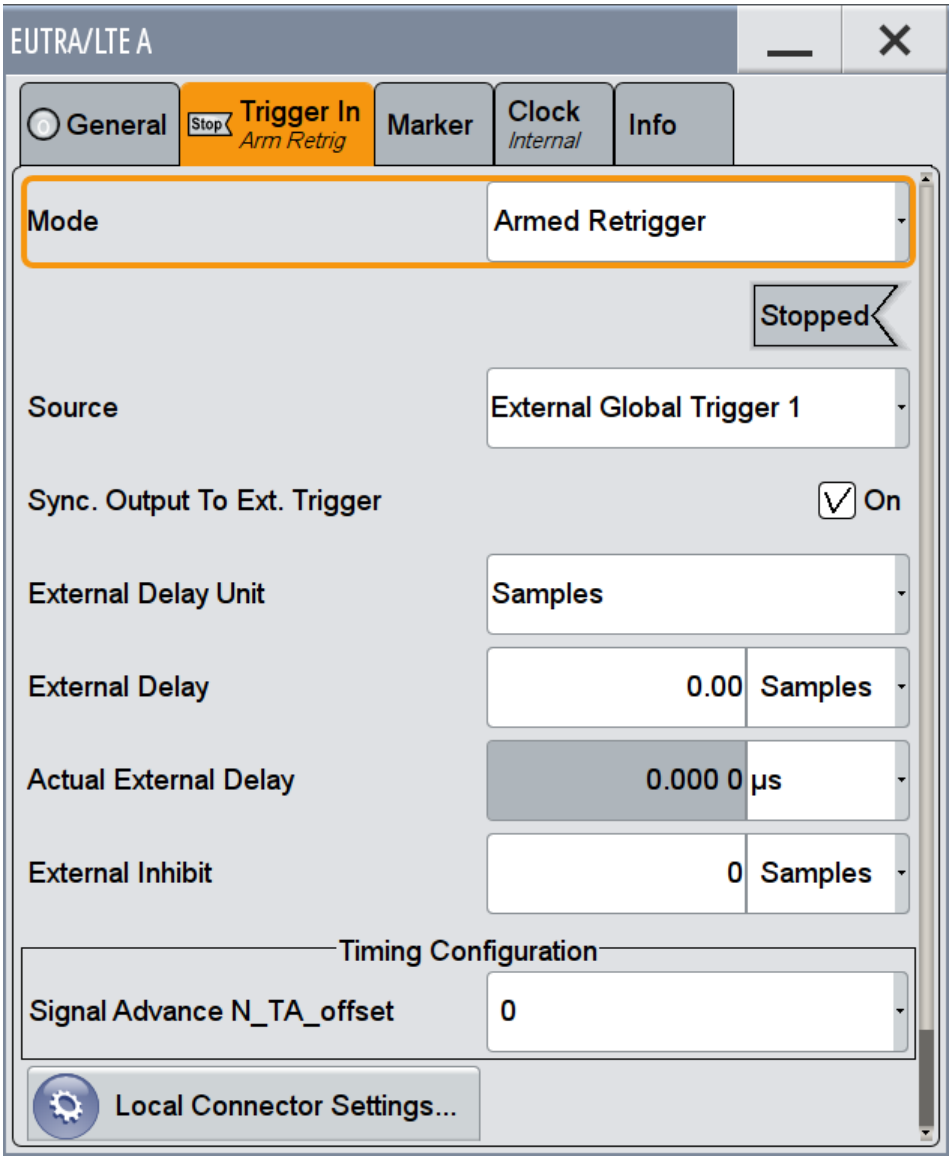
**Filter / Clipping / ARB /TDW/Power Settings**
Accesses the dialog for setting baseband filtering, clipping and the sequence length of the arbitrary waveform component, see chapter 7.20, "Filter/Clipping/Power Settings", on page 262.

## 7.2 Trigger Settings

This dialog provides access to the settings necessary to select and configure the trigger, like trigger source, mode, trigger delay, trigger suppression, as well as to arm or trigger an internal trigger manually. The current signal generation status is displayed in the header of the tab together with information on the enabled trigger mode. As in the "Marker" and "Clock" tabs, this tab provides also an access to the settings of the related connectors.

This section focuses on the available settings.

For information on how this settings affect the signal, refer to chapter "Basics" in the R&S SMW User Manual.




**Routing and Enabling a Trigger**

The provided trigger signals are not dedicated to a particular connector but can be mapped to one or more globally shared USER or local T/M/(C) connectors.

Use the Local and Global Connector Settings to configure the signal mapping as well as the polarity, the trigger threshold and the input impedance of the input connectors.

To route and enable a trigger signal, perform the following *general steps*:

- Define the signal source and the effect of a trigger event, i.e. select the "Trigger In > Mode" and "Trigger In > Source"
- Define the connector, USER or T/M/(C), the selected signal is provided at, i.e. configure the Local and Global Connector Settings.

**Trigger Mode**
Selects trigger mode, i.e. determines the effect of a trigger event on the signal generation.

**Note:** To enable simultaneous signal generation in all basebands, the trigger settings in the available basebands are coupled in any instrument's configuration involving signal routing with signal addition (e.g. MIMO configuration, routing and summing of basebands and/or streams).

For more information, refer to chapter "Basics" in the R&S SMW user manual.

- "Auto"
  The signal is generated continuously.
- "Retrigger"
  The signal is generated continuously. A trigger event (internal or external) causes a restart.
- "Armed_Auto"
  The signal is generated only when a trigger event occurs. Then the signal is generated continuously.
  An "Arm" stops the signal generation. A subsequent trigger event (internal with or external) causes a restart.
- "Armed_Retrigger"
  The signal is generated only when a trigger event occurs. Then the signal is generated continuously. Every subsequent trigger event causes a restart.
  An "Arm" stops signal generation. A subsequent trigger event (internal with or external) causes a restart.
- "Single"
  The signal is generated only when a trigger event occurs. Then the signal is generated once to the length specified at "Signal Duration".
  Every subsequent trigger event (internal or external) causes a restart.

Remote command:
`[:SOURce<hw>]:BB:EUTRa[:TRIGger]:SEQuence` on page 385

**Signal Duration Unit**
Defines the unit for describing the length of the signal sequence to be output in the "Single" trigger mode.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TRIGger:SLUNit` on page 391

**Trigger Signal Duration**
Enters the length of the signal sequence to be output in the "Single" trigger mode. The input is expressed in the signal units.

Use this parameter to deliberately output part of the signal, an exact sequence of the signal, or a defined number of repetitions of the signal.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TRIGger:SLENgth` on page 391

**Running/Stopped**
For enabled modulation, displays the status of signal generation for all trigger modes.

- "Running"

The signal is generated; a trigger was (internally or externally) initiated in triggered mode.

- "Stopped"
  The signal is not generated and the instrument waits for a trigger event.

Remote command:
[:SOURce<hw>]:BB:EUTRa:TRIGger:RMODe? on page 390

**Arm**
Stops the signal generation until subsequent trigger event occurs.

Remote command:
[:SOURce<hw>]:BB:EUTRa:TRIGger:ARM:EXECute on page 386

**Execute Trigger**
For internal trigger source, executes trigger manually.

Remote command:
[:SOURce<hw>]:BB:EUTRa:TRIGger:EXECute on page 387

**Trigger Source**
**Note:** To enable simultaneous signal generation in all basebands, the trigger settings in the available basebands are coupled in any instrument's configuration involving signal routing with signal addition (e.g. MIMO configuration, routing and summing of basebands and/or streams).

For more information, refer to chapter "Basics" in the R&S SMW user manual.

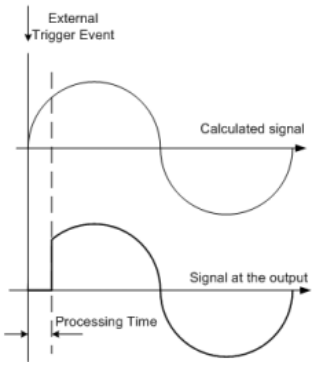
The following sources of the trigger signal are available:

- "Internal"
  The trigger event is executed manually by the "Execute Trigger".
- "Internal (Baseband A/B)"
  The trigger event is provided by the trigger signal from the other basebands.
- "External Global Trigger 1 / 2"
  The trigger event is the active edge of an external trigger signal provided and configured at the global USER connectors.
- "External Global Clock 1 / 2"
  The trigger event is the active edge of an external global clock signal provided and configured at the global USER connectors.
- "External Local Trigger"
  The trigger event is the active edge of an external trigger signal provided and configured at the local T/M/(C) connector.
  With coupled trigger settings, the signal has to be provided at the T/M/C 1/2/3 connectors.
- "External Local Clock"
  The trigger event is the active edge of an external local clock signal provided and configured at the local T/M/C connector.
  With coupled trigger settings, the signal has to be provided at the T/M/C 1 connector.

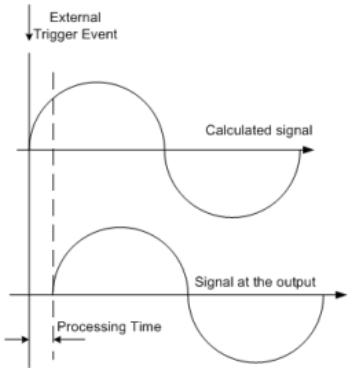
Remote command:
[:SOURce<hw>]:BB:EUTRa:TRIGger:SOURce on page 392

**Sync. Output to External Trigger**
For an external trigger signal, enables/disables the output of a signal synchronous to the external trigger event.

"On" Corresponds to the default state of this parameter.
The signal calculation starts simultaneously with the external trigger event but because of the instrument's processing time the first samples are cut off and no signal is output. After elapsing of the internal processing time, the output signal is synchronous to the trigger event.




"Off" The signal output begins after elapsing of the processing time and starts with sample 0, i.e. the complete signal is output.
This mode is recommended for triggering of short signal sequences with signal duration comparable with the processing time of the instrument.




Remote command:
`[:SOURce<hw>]:BB:EUTRa:TRIGger:EXTernal:SYNChronize:OUTPut` on page 388

**External Delay Unit**
Determine whatever the trigger delay is expressed in samples or directly defined as a time period (seconds).

The parameter Trigger Settings displays the delay converted in time.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TRIGger:DELay:UNIT` on page 387

**External Trigger Delay**
For external trigger signal or trigger signal from the other path, sets the trigger signal delay.

One possible application field of this feature is the synchronization of the instrument with the device under test (DUT) or other external devices.

For more information, see chapter "Basics" in the R&S SMW User Manual.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TRIGger[:EXTernal]:DELay` on page 393
`[:SOURce<hw>]:BB:EUTRa:TRIGger:EXTernal<ch>:TDELay` on page 388
`[:SOURce<hw>]:BB:EUTRa:TRIGger:OBASeband:DELay` on page 389
`[:SOURce<hw>]:BB:EUTRa:TRIGger:OBASeband:TDELay` on page 390

**Actual External Delay**
Indicates the resulting external trigger delay in "Time" unit.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TRIGger:EXTernal<ch>:RDELay?` on page 387
`[:SOURce<hw>]:BB:EUTRa:TRIGger:OBASeband:RDELay?` on page 389

**External Trigger Inhibit**
For external trigger signal or trigger signal from the other path, sets the duration a new trigger event subsequent to triggering is suppressed. In "Retrigger" mode for example, a new trigger event will not cause a restart of the signal generation until the specified inhibit duration does not expire.

For more information, see chapter "Basics" in the R&S SMW User Manual.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TRIGger[:EXTernal]:INHibit` on page 394
`[:SOURce<hw>]:BB:EUTRa:TRIGger:OBASeband:INHibit` on page 389

**Signal Advance N_TA_offset**
Sets the parameter $N_{TA\ offset}$ as defined in the 3GPP TS 36.211.

The parameter is available in "Uplink" direction and enabled "TDD" mode.

The 3GPP TS 36.211 defines the signal advance parameter depending on the duplexing mode and specifies the following values:

- for FDD mode: $N_{TA\ offset} = 0$
- for TDD mode: $N_{TA\ offset} = 624$.

In this implementation, however, the signal advance for the TDD mode can also be set to 0.

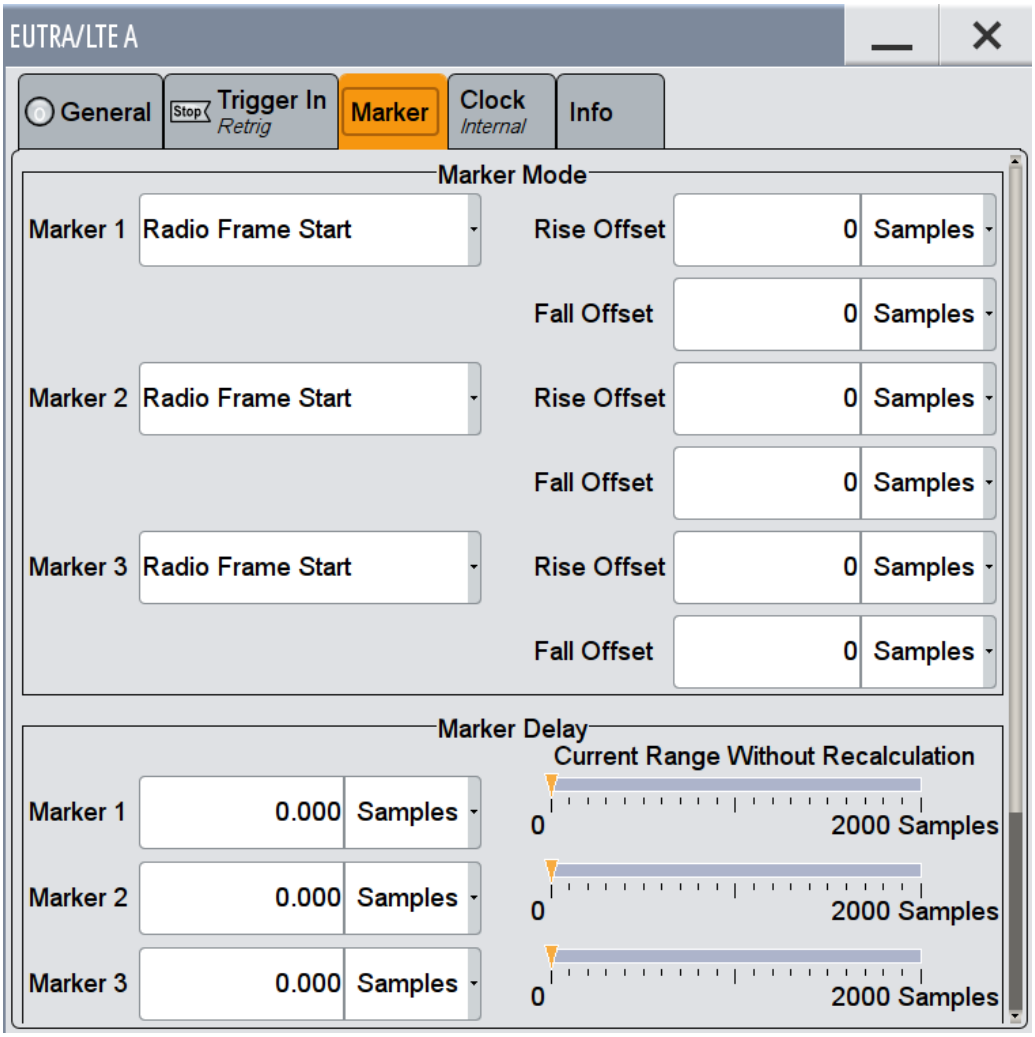
**Note:** The time shift due to the N_TA_offset is independent from the time shifts caused by the realtime feedback parameter Initial Timing Advance or by timing advance/adjustment commands. According to 3GPP TS 36.211, the resulting time shift is the sum of the selected time shifts.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TIMC:NTAoffset` on page 384

## 7.3 Marker Settings

This tab provides an access to the settings necessary to select and configure the marker output signal, like the marker mode or marker delay settings.

This section focuses on the available settings.
For information on how this settings affect the signal, refer to chapter "Basics" in the R&S SMW User Manual.



**Routing and Enabling a Marker**

The provided marker signals are not dedicated to a particular connector but can be mapped to one or more globally shared USER or local T/M/(C) connectors.

To route and enable a marker signal, perform the following *general steps*:

- Define the shape of the generated marker, i.e. select the "Marker > Mode"
- Define the connector, USER or T/M/(C), the selected signal is output at, i.e. configure the Local and Global Connector Settings.

**Marker Mode**

Marker configuration for up to three marker channels. The settings are used to select the marker mode defining the shape and periodicity of the markers. The contents of the dialog change with the selected marker mode.

"Restart (ARB)" A marker signal is generated at the start of each ARB sequence.

"Radio Frame Start" A marker signal is generated at the start of each radio frame.

"Frame Active Part" The marker signal is high whenever a burst is active and low during inactive signal parts (such as the gaps between bursts in uplink mode or the uplink subframe in downlink TDD mode).
This marker can be used to decrease the carrier leakage during inactive signal parts by feeding it into the pulse modulator.

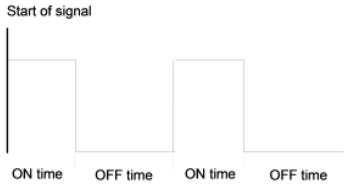
"Subframe" A marker signal is generated at the start of each subframe.

"User Period" A marker signal is generated at the beginning of every user-defined period. The period is defined in "Period."

Remote command:

`[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:PERiod` on page 398

"ON/OFF Period" A regular marker signal that is defined by an ON/OFF ratio is generated. A period lasts one ON and OFF cycle.
The "ON Time" and "OFF Time" are each expressed as a number of samples and are set in an input field which opens when ON/OFF ratio is selected.




Remote command:

`[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:OFFTime` on page 398

`[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:ONTime` on page 398

"Internally Used" Special marker signal for the realtime feedback mode (chapter 6, "Real-time Feedback for Closed Loop BS Tests", on page 62) or for the "SFN Restart Period 3GPP (1024 Frames)".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:MODE` on page 396

**Rise/Fall Offset**
(Available for marker mode Subframe, Radio Frame Start, and Restart (ARB) only)

Sets the value for the rise/fall offset. The rising ramp of the marker is shifted by the set value in samples. Positive values shift the rising ramp to later positions; negative values shift it to earlier positions.

The value range is -640000 to 640000.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:ROFFset` on page 398
`[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:FOFFset` on page 398

**Marker x Delay**
Defines the delay between the marker signal at the marker outputs relative to the signal generation start.

"Marker x" For the corresponding marker, sets the delay as a number of symbols.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:DELay` on page 395

"Current Range without Recalculation"
Displays the dynamic range within which the delay of the marker signals can be set without restarting the marker and the signal.
Move the setting mark to define the delay.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:DELay:MAXimum?` on page 395
`[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:DELay:MINimum?` on page 396

"Fix marker delay to current range"
Restricts the marker delay setting range to the dynamic range.

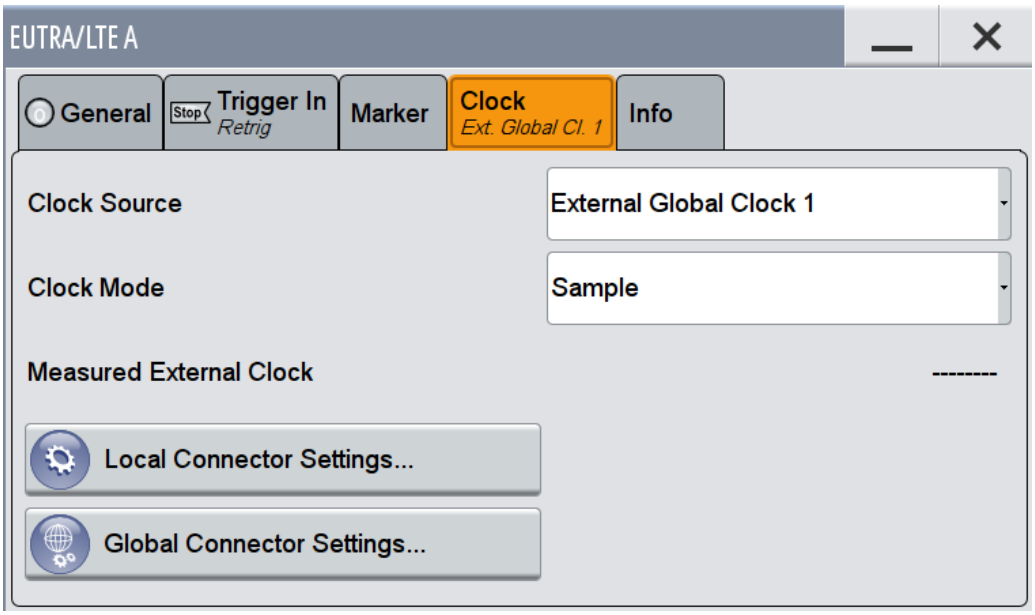
Remote command:
`[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut:DELay:FIXed` on page 395

## 7.4 Clock Settings

This tab provides an access to the settings necessary to select and configure the clock signal, like the clock source and clock mode.

This section focuses on the available settings.

For information on how this settings affect the signal, refer to chapter "Basics" in the R&S SMW User Manual.




**Defining the Clock**

The provided clock signals are not dedicated to a particular connector but can be mapped to one or more globally shared USER and the two local T/M/C connectors.

Use the Local and Global Connector Settings to configure the signal mapping as well as the polarity, the trigger threshold and the input impedance of the input connectors.

To route and enable a trigger signal, perform the following *general steps*:

- Define the signal source, i.e. select the "Clock > Source"
- Define the connector, USER or T/M/C, the selected signal is provided at, i.e. configure the Local and Global Connector Settings.

**Clock Source**

Selects the clock source.

- "Internal"
  The instrument uses its internal clock reference.
- "External Global Clock 1/2"
  The instrument expects an external clock reference at the global USER connector, as configured in the "Global Connector Settings" dialog.
- "External Local Clock"
  The instrument expects an external clock reference at the local T/M/C connector.

Remote command:

`[:SOURce<hw>]:BB:EUTRa:CLOCk:SOURce` on page 383

**Clock Mode**
Enters the type of externally supplied clock.

Remote command:
[:SOURce<hw>]:BB:EUTRa:CLOCk:MODE on page 382

**Clock Multiplier**
Enters the multiplication factor for clock type "Multiple".

Remote command:
[:SOURce<hw>]:BB:EUTRa:CLOCk:MULTiplier on page 384

**Custom External Clock**
Specifies the parameter for clock type "Custom" in case of external clock source.

Remote command:
[:SOURce<hw>]:BB:EUTRa:CLOCk:CUSTom on page 383

**Measured External Clock**
Provided for permanent monitoring of the enabled and externally supplied clock signal.

Remote command:
CLOCk:INPut:FREQuency?

## 7.5 Local and Global Connector Settings

Each of the "Trigger In", "Marker" and "Clock" dialogs as well as the "Trigger Marker Clock" dialog provides a quick access to the related local and global connector settings.

For more information, refer to the description R&S SMW User Manual, section "Local and Global Connectors".

## 7.6 Local and Global Connector Settings

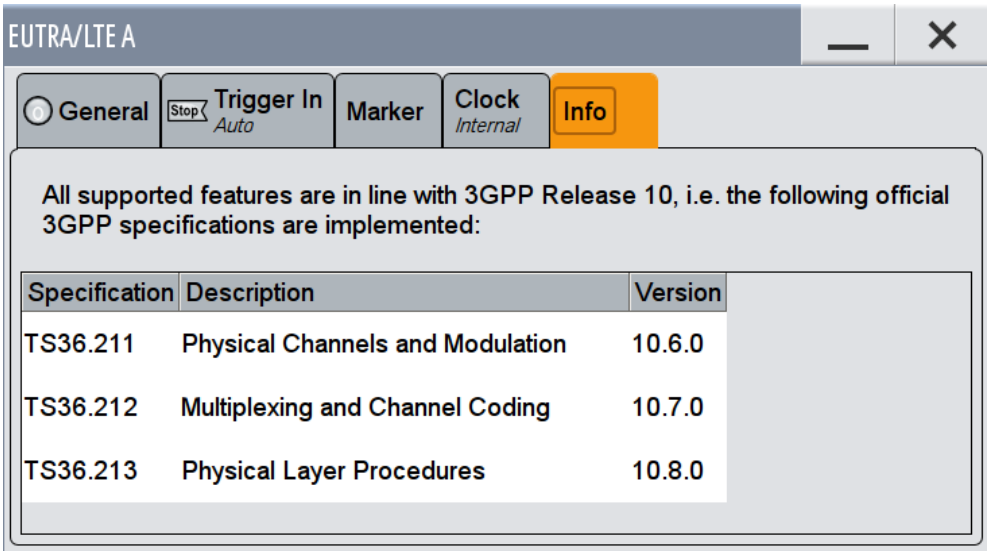
Each of the "Trigger In", "Marker" and "Clock" dialogs as well as the "Trigger Marker Clock" dialog provides a quick access to the related local and global connector settings.

For more information, refer to the description R&S SMW User Manual, section "Local and Global Connectors".

## 7.7 Info Dialog

The Info dialog displays the currently supported version of the 3GPP standard.

► To access this dialog, select "Baseband > EUTRA/LTE > Info".




The default settings and parameters provided are oriented towards the specifications of the version displayed.
Remote control command:
`[:SOURce]:BB:EUTRa:VERSion?` on page 373

## 7.8 LTE Logfile Generation

Logfile generation functionality requires the additional option R&S SMW-K81.

This functionality enables you to generate logfiles for exchanging intermediate results of different logging points in the signal processing chain. Analysing the content of the logfiles may help to verify the signal processing chain in both the DL and UL direction. The intermediate results provide a basis for enhanced debugging. To verify the FEC implementation of the DUT for instance, the coded bitstream from the instrument can be loaded into a Rx software module for offline analysis in a simulation environment, or it can be compared to the bitstreams from a Tx software module. Due to the full remote control of this functionality, optimization of the design flow with process automatization can be achived, too.

### 7.8.1 Signal Processing Chains and Logging Points

Logfile generation can be enabled after a completed processing step of the selected channel, at the so called logging point. Logging points (PTxx) are available after each completed processing stage up to the "Precoding", as shown on the figures bellow.

The results of the "Resource Element Mapping/OFDM Mapper" are not logged!

For detailed information about the signal processing of all channels, refer to the corresponding 3GPP specification.

### Signal Processing in Downlink

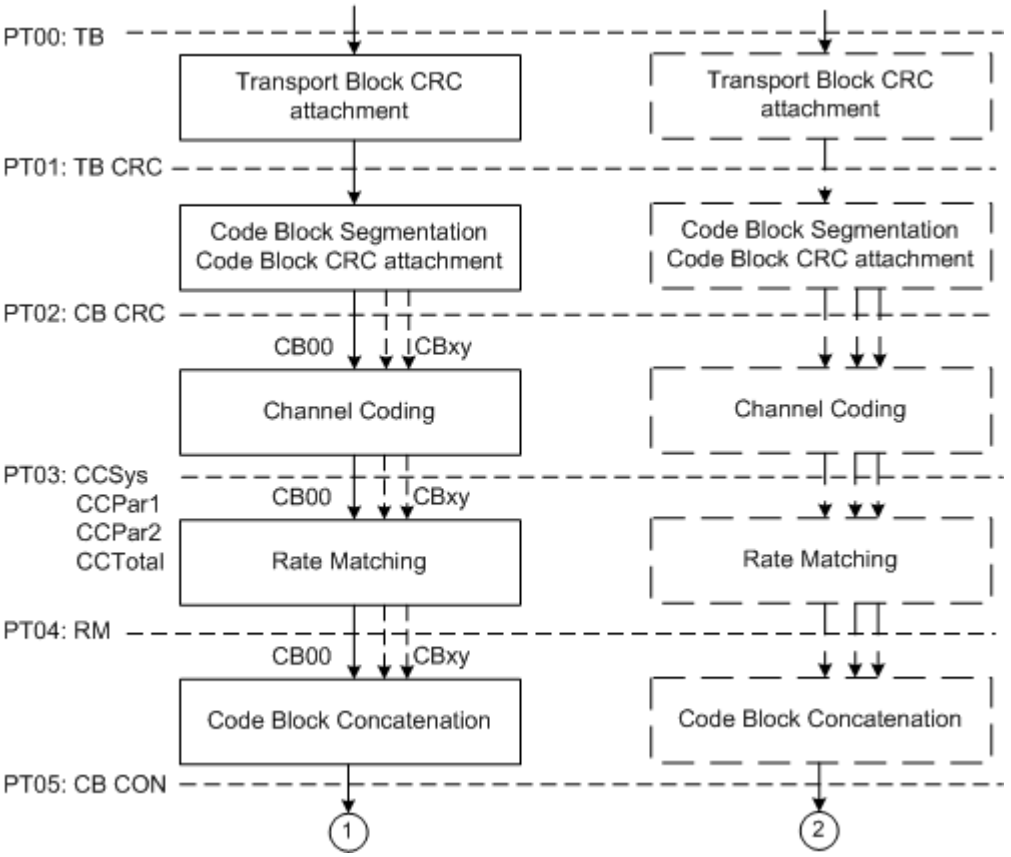



*Fig. 7-1: Transport channel processing for DL-SCH (according to 3GPP TS 36.212)*

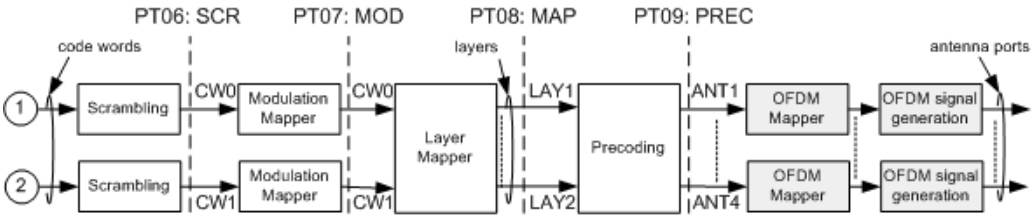



*Fig. 7-2: Overview of physical channel processing (according to 3GPP TS 36.211)*

The table 7-1 gives an overview of the logging point available for the DL channels.

*Table 7-1: Available logging points per DL channel*

| Point/ Channel | PT00 TB | PT01 TBCRC | PT02 CBCRC | PT03 CC | PT04 RM | PT05 CBCON | PT06 SCR | PT07 MOD | PT08 MAP | PT09 PREC |
|---|---|---|---|---|---|---|---|---|---|---|
| PDSCH | X | X | X | X | X | X | X | X | X | X |
| PBCH [1)] | X | X | | X | X | | X | X | X | X |

| Point/ Channel | PT00 TB | PT01 TBCRC | PT02 CBCRC | PT03 CC | PT04 RM | PT05 CBCON | PT06 SCR | PT07 MOD | PT08 MAP | PT09 PREC |
|---|---|---|---|---|---|---|---|---|---|---|
| PCFICH [1] | X | | | | | | X | X | X | X |
| PHICH [1] | X | | | | | | | X [2] | X [2] | X [2] |
| PDCCH [1] | X [3] | X [3] | | X [3] | X [3] | X | X | X | X | X |
| PMCH[1] | X | X | | X | X | | X | X | X | X |

[1] the channel has one codeword and one code block

[2] an individual file is generated per PHICH group

[3] an individual file is generated per DCI

### Signal Processing in Uplink

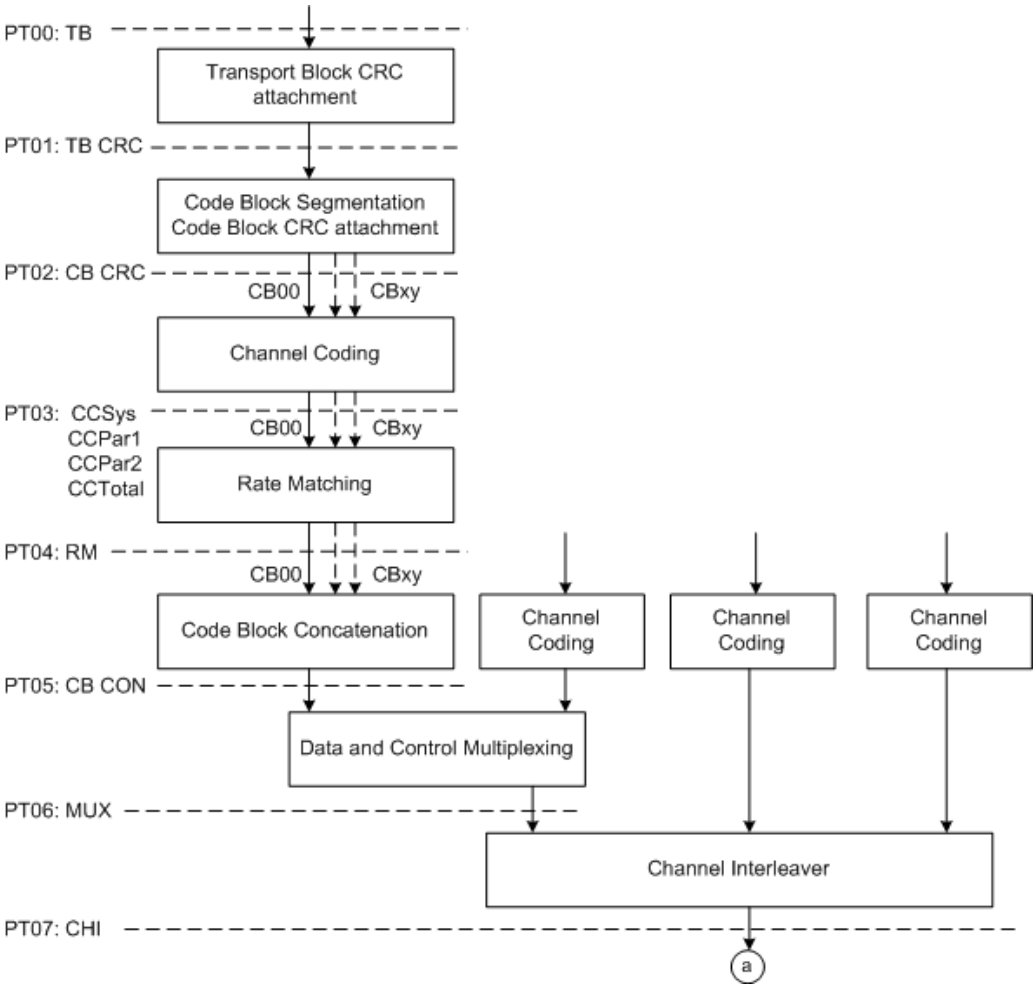



*Fig. 7-3: Transport channel processing for UL-SCH (according to 3GPP TS 36.212)*

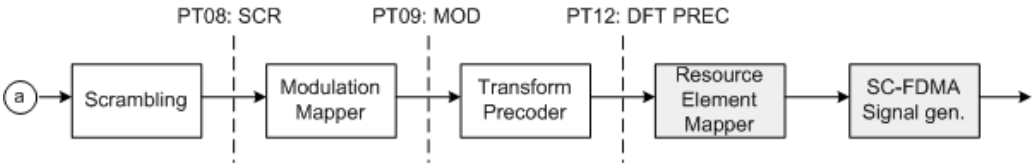



*Fig. 7-4: Overview of uplink physical channel processing (according to 3GPP TS 36.211)*

Refer to table 7-2 for an overview of logging points available for the UL channels.

*Table 7-2: Available logging points per UL channel*

| Point / Channel | PT00 TB | PT01 TBCRC | PT02 CBCRC | PT03 CC | PT04 RM | PT05 CBCON | PT06 MUX | PT07 CHI | PT08 SCR | PT09 MOD | PT10 MAP | PT11 PREC | PT12 DFT PREC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PUSCH | X | X | X | X | X | X | X | X | X | X | - | - | X |

In the uplink direction, logging points PT10 and PT11 are reserved for future use.

## 7.8.2 Output Files

The instrument stores the output logfiles in a user-defined network directory, selected with the parameter Output Path. The logfiles are named according to the naming conventions described in chapter 7.8.2.1, "File Names", on page 93. Description of the available file formats is given bellow.

### File Formats

Generally, the logfiles are generated in two file formats:

- Bitstream
  The logfile contains a sequence of "1" and "0"; one value per line
  The logfile of the PHICH contains also the entry "-" that corresponds to DTX.
- IQ Samples
  The logfile contains pairs of I and Q samples; one I or Q sample per line

File format IQ Samples is used for the logfiles generated for the logging points "Modulation Mapping", "Layer Mapping" and "Precoding". The other logfiles are output in a Bitstream format.

An exception are the extended DCI/UCI logfiles (see "Extended DCI Logfile" on page 97 and "Extended UCI Logfile" on page 99).

### 7.8.2.1 File Names

The generated logging files are named according to the following naming structure:

`[<Preamble>_]<Frame#>_<Subframe#>_<Channel>[_<User/Allocation#>|<DCI#>|<Group#>]_<Point#>[_<CW#>|<LAY#>|<ANT#>]_<PointName>[_<CodeBlock#>].dat`

An exception are the extended DCI/UCI logfiles. The file names of these two logfiles are as follow:

`[<Preamble>_]ExtendedDciLog.txt` and
`[<Preamble>_]ExtendedUciLog.txt`

***Table 7-3: Description of the File Name Structure***

| | **Description** | **Value Range** |
|---|---|---|
| `<Preamble>` | Optional user-defined preamble | - |
| `<Frame#>` | Frame Number | F000 .. F873 |
| `<Subframe#>` | Subframe Number | SF0 .. SF9 |
| `<Channel>` | Channel Name | DL: PBCH \| PCFICH \| PHICH \| PDCCH \| PDSCH \| PMCH |
| | | UL: PUSCH |
| `<User/Allocation#>` | PDSCH allocation only | USER1 .. USER4<br>ALL000 .. ALL101 |
| `<DCI#>` | PDCCH allocation only<br>each PDCCH DCI is logged individually | DCI00 .. DCI19 |
| `<Group#>` | PHICH Group<br>an individual file is generated for each PHICH group | Group00 \| Group01 |
| `<Point#>` | Logging Point Number | see table 7-4 |
| `<CW#>` | PDSCH allocation only<br>Codeword | CW0 \| CW1 |
| `<LAY#>` | Layer Number | LAY1 \| LAY2 |
| `<ANT#>` | Antenna Number | ANT1 .. ANT4 |
| `<PointName>` | Logging Point designation | see table 7-4 |
| `<CodeBlock#>` | PDSCH allocation only | CB00 .. CB20 |

There is a fixed cross-reference between the logging point number and the logging point designation (see table 7-4).

***Table 7-4: Logging Points Overview***

| **<Point#>** | **<PointName>** | **Description** |
|---|---|---|
| PT00 | TB | Bits of the Transport Block |
| PT01 | TBCRC | Bits after Transport Block CRC |
| PT02 | CBCRC | Bits after Code Block CRC<br>One file per code block is generated |
| PT03 | | Bits after Channel Coding (one file per code block) |

| <Point#> | <PointName> | Description |
|---|---|---|
| | CCSys | Systematic Bits |
| | CCPar1 | Parity 1 Bits |
| | CCPar2 | Parity 2 Bits |
| | CCTotal | PDSCH and PUSCH allocation only<br>Complete bit-stream after channel coding, incl. systematic, parity 1 and parity 2 bits |
| PT04 | RM | Bits after Rate Matcher (one file per code block) |
| PT05 | CBCON | Bits after Code Block Concatenation |
| PT06 | DL: SCR | Bits after Scrambling |
| | UL: MUX | Bits after Data and Control Multiplexing |
| PT07 | DL: MOD | IQ-Samples after Modulation |
| | UL: CHI | Bits after channel interliever |
| PT08 | DL: MAP | IQ-Samples after Layer Mapping (one file per layer) |
| | UL: SCR | Bits after Scrambling |
| PT09 | DL: PREC | IQ-Samples after Precoding (one file per antenna) |
| | UL: MOD | IQ-Samples after Modulation |
| PT10 | UL: MAP | Reserved for future use |
| PT11 | UL: PREC | |
| PT12 | UL: DFT_PREC | IQ-Samples after DFT |

**Example: List of the output logfiles for PDSCH**

The following output files are generated for one PDSCH channel, configured on a allocation with index `ALL002` in the third subframe (`SF2`) of the first frame (`F000`). The instrument is configured to generate a MIMO signal with two antennas (`PREC_ANT1` and `PREC_ANT2`). Channel coding and scrambling are enabled (`CCPar1`, `CCPar2`, `CCSys`, `CCTotal` and `SCR`). Two codewords (`CW0` and `CW1`) and two layers (`LAY0` and `LAY1`) are used; three code blocks per code (`CB00`, `CB01`, `CB02`) are generated.

All logging points are enabled and a preamble (`20100825Log`) is selected.

```
<User/
Allocation#>_<Point#>[_<CW#>|<LAY#>|<ANT#>]_<PointName>[_<CodeBlock#>].dat

20100825Log_F000_SF2_PDSCH_ALL002_PT00_CW0_TB.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT00_CW1_TB.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT01_CW0_TBCRC.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT01_CW1_TBCRC.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT02_CW0_CBCRC_CB00.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT02_CW1_CBCRC_CB00.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT02_CW0_CBCRC_CB01.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT02_CW1_CBCRC_CB01.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT02_CW0_CBCRC_CB02.dat
```

```
20100825Log_F000_SF2_PDSCH_ALL002_PT02_CW1_CBCRC_CB02.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW0_CCPar1_CB00.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW1_CCPar1_CB00.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW0_CCPar1_CB01.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW1_CCPar1_CB01.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW0_CCPar1_CB02.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW1_CCPar1_CB02.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW0_CCPar2_CB00.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW1_CCPar2_CB00.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW0_CCPar2_CB01.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW1_CCPar2_CB01.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW0_CCPar2_CB02.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW1_CCPar2_CB02.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW0_CCSys_CB00.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW1_CCSys_CB00.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW0_CCSys_CB01.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW1_CCSys_CB01.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW0_CCSys_CB02.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW1_CCSys_CB02.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW0_CCTotal_CB00.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW1_CCTotal_CB00.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW0_CCTotal_CB01.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW1_CCTotal_CB01.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW0_CCTotal_CB02.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW1_CCTotal_CB02.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT04_CW0_RM_CB00.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT04_CW1_RM_CB00.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT04_CW0_RM_CB01.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT04_CW1_RM_CB01.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT04_CW0_RM_CB02.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT04_CW1_RM_CB02.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT05_CW0_CBCON.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT05_CW1_CBCON.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT06_CW0_SCR.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT06_CW1_SCR.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT07_CW0_MOD.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT07_CW1_MOD.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT08_LAY0_MAP.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT08_LAY1_MAP.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT09_ANT1_PREC.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT09_ANT2_PREC.dat
```

#### 7.8.2.2 Extended Logfiles Contents

The instrument generates only one logfile with extended information regarding the DCI/ UCI mapping.

### Extended DCI Logfile

An Extended DCI Logfile summarizes the information for the whole generated signal and may contains information for more than one frame. The information is grouped in rows with different syntax.

- PCFICH mapping, i.e the resource elements the PCFICH REGs are mapped to
  `<Frame#>, <Subframe#>,`
  `PCFICH: REG-Idx=<REG#>: Subcarrier=<Subcarrier#>,`
  `Symbol=<OFDMSymbol#>`
- PHICH mapping, i.e the resource elements the PHICH REGs of the individual PHICH groups are mapped to
  `<Frame#>, <Subframe#>,`
  `PHICH: Group=<Group#>: REG-Idx=<REG#>: Subcarrier=<Subcarrier#>`
  `, Symbol=<OFDMSymbol#>`
- PDCCH number of useful REGs
  `<Frame#>, <Subframe#>, PDCCH: Colums:<Colums#>, Rows:<Rows#>,`
  `Useful REGs:<REG#>`
  The Number of Useful REGs corresponds to the value displayed with the parameter Number of available REGs (PDCCH)Number of Available REGs.
- The start CCE-Index of the individual DCIs
  `<Frame#>, <Subframe#>, DCI: DCI Idx=<DCI#>, Start CCE-Idx=<CCE#>`
  The DCI Idx corresponds to the row in the DCI Table and the Start CCE-Idx is the CCE Index for the corresponding DCI.
- PDCCH mapping, i.e the resource elements the PDCCH REGs of the individual PDCCHs are mapped to
  `<Frame#>, <Subframe#>,`
  `PDCCH: Idx=<Symbol#>: REG-Idx=<REG#>: Subcarrier=<Subcarrier#>`
  `, Symbol=<OFDMSymbol#> [--- DTX REG]`
  The additional information DTX REG is assigned to all Dummy PDCCH REGs (see "Number of Dummy REGs" on page 169 ).

Sub-carrier with index 0 is the most left sub-carrier, i.e. the one belonging to the resource block 0.

**Example: Content of an Extended DCI Logfile**

The instrument is configured to generate a DL LTE signal with 1.4MHz bandwidth (6 RBs), normal Cyclic Prefix, Extended PHICH Duration and Control Region for PDCCH of 3 OFDM symbols. Two Antennas are selected, path A generate the signal of Antenna 1 and Path B, the signal of Antenna 2.

A PDCCH Format Variable is selected and the PDCCH is configured as given on the figure bellow.

| | User | UE_ID n_RNTI | Cell Index | DCI Format | Search Space | Content | PDCCH Format | Number CCEs | CCE Index | No.Dummy CCEs | Conflict |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | User1 | 0 | 0 | 0 | Off | Config... | 1 | 2 | 0 | 0 | |
| 1 | SI-RNTI | 65535 | 0 | 1A | Off | Config... | 0 | 1 | 2 | 1 | |

Generation of Extended DCI Logfile is enabled and the file contains the following information (only the beginning of the file is listed):

```
F00,SF0,PCFICH: REG-Idx=0: Subcarrier=1, Symbol=0
F00,SF0,PCFICH: REG-Idx=0: Subcarrier=2, Symbol=0
F00,SF0,PCFICH: REG-Idx=0: Subcarrier=4, Symbol=0
F00,SF0,PCFICH: REG-Idx=0: Subcarrier=5, Symbol=0
F00,SF0,PCFICH: REG-Idx=1: Subcarrier=19, Symbol=0
F00,SF0,PCFICH: REG-Idx=1: Subcarrier=20, Symbol=0
F00,SF0,PCFICH: REG-Idx=1: Subcarrier=22, Symbol=0
F00,SF0,PCFICH: REG-Idx=1: Subcarrier=23, Symbol=0
F00,SF0,PCFICH: REG-Idx=2: Subcarrier=37, Symbol=0
F00,SF0,PCFICH: REG-Idx=2: Subcarrier=38, Symbol=0
F00,SF0,PCFICH: REG-Idx=2: Subcarrier=40, Symbol=0
F00,SF0,PCFICH: REG-Idx=2: Subcarrier=41, Symbol=0
F00,SF0,PCFICH: REG-Idx=3: Subcarrier=55, Symbol=0
F00,SF0,PCFICH: REG-Idx=3: Subcarrier=56, Symbol=0
F00,SF0,PCFICH: REG-Idx=3: Subcarrier=58, Symbol=0
F00,SF0,PCFICH: REG-Idx=3: Subcarrier=59, Symbol=0

F00,SF0,PHICH: Group=0: REG-Idx=0: Subcarrier=7, Symbol=0
F00,SF0,PHICH: Group=0: REG-Idx=0: Subcarrier=8, Symbol=0
F00,SF0,PHICH: Group=0: REG-Idx=0: Subcarrier=10, Symbol=0
F00,SF0,PHICH: Group=0: REG-Idx=0: Subcarrier=11, Symbol=0
F00,SF0,PHICH: Group=0: REG-Idx=1: Subcarrier=24, Symbol=1
F00,SF0,PHICH: Group=0: REG-Idx=1: Subcarrier=25, Symbol=1
F00,SF0,PHICH: Group=0: REG-Idx=1: Subcarrier=26, Symbol=1
F00,SF0,PHICH: Group=0: REG-Idx=1: Subcarrier=27, Symbol=1
F00,SF0,PHICH: Group=0: REG-Idx=2: Subcarrier=48, Symbol=2
F00,SF0,PHICH: Group=0: REG-Idx=2: Subcarrier=49, Symbol=2
F00,SF0,PHICH: Group=0: REG-Idx=2: Subcarrier=50, Symbol=2
F00,SF0,PHICH: Group=0: REG-Idx=2: Subcarrier=51, Symbol=2

F00,SF0,PDCCH: Columns:32, Rows:2, Useful REGs:41
F00,SF0,DCI: DCI Idx=0: Start CCE-Idx=0
F00,SF0,DCI: DCI Idx=1: Start CCE-Idx=2
```

```
F00,SF0,PDCCH: Idx=0: REG-Idx=10: Subcarrier=0, Symbol=1
F00,SF0,PDCCH: Idx=0: REG-Idx=10: Subcarrier=1, Symbol=1
F00,SF0,PDCCH: Idx=0: REG-Idx=10: Subcarrier=2, Symbol=1
F00,SF0,PDCCH: Idx=0: REG-Idx=10: Subcarrier=3, Symbol=1
F00,SF0,PDCCH: Idx=1: REG-Idx=26: Subcarrier=0, Symbol=2
F00,SF0,PDCCH: Idx=1: REG-Idx=26: Subcarrier=1, Symbol=2
F00,SF0,PDCCH: Idx=1: REG-Idx=26: Subcarrier=2, Symbol=2
F00,SF0,PDCCH: Idx=1: REG-Idx=26: Subcarrier=3, Symbol=2
.......
```

The figure 7-5 shows the resource allocation for this example. See also chapter 3.2.4, "Downlink Control Information Transmission", on page 21.

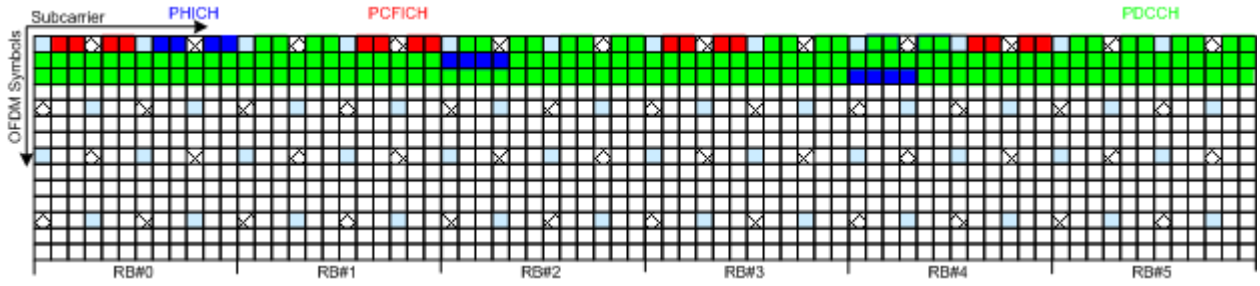



***Fig. 7-5: Example of Downlink Control Information Mapping***

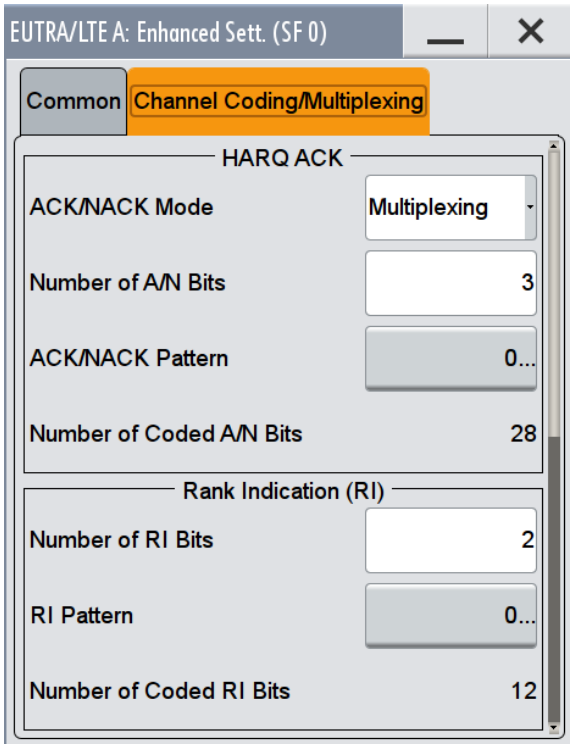
### Extended UCI Logfile

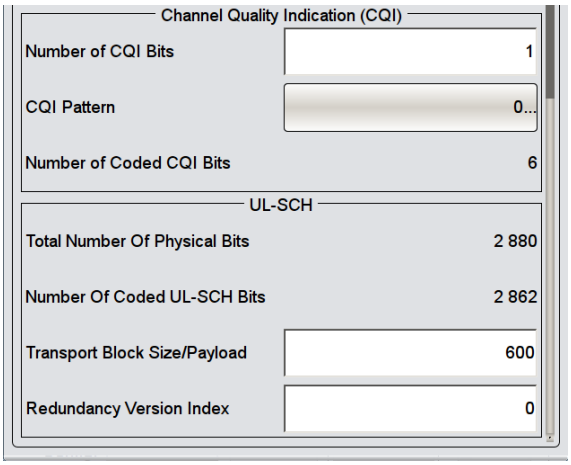
The Extended UCI Logfile summarizes the information for the whole generated signal and may contains information for more than one frame. The information is grouped in rows with the following syntax:

```
<Frame#>, <Subframe#>,
PUSCH <ChannelCodingMode> Number of Bits: No.HARQ Bits=<HARQ#>,
No.RI Bits=<RI#>,No.CQI Bits=<CQI#>,
No.coded HARQ Bits=<CodedHARQ#>,No.coded RI Bits=<CodedRI#>,
No.coded CQI Bits=<CodedCQI#>,No.coded UL-SCH Bits=<UL-SCH#>
```

**Example:**

The PUSCH carries multiplexed control information and data (`UCI+UL-SCH`) and the channel is configured as shown on the figure bellow:




The first line of the logfile is:

```
F00,SF0,
PUSCH UCI+UL-SCH Number of Bits: No.HARQ Bits=3,No.RI Bits=2,No.CQI Bits=1
,No.coded HARQ Bits=28,No.coded RI Bits=12,No.coded CQI Bits=6,
No.coded UL-SCH Bits=2862
```

### 7.8.3 Working with the Logfile Generation Functionality

The R&S SMW generates logfiles only if the logging state is enabled. Adjusting the settings in the "Logfile Generation" dialog does not affect the content of the generated EUTRA/LTE signal and does not cause a recalculation of the signal. The generation of new logfiles is triggered by changing of a signal relevant EUTRA/LTE parameter or by enabling/disabling the generation of EUTRA/LTE signal.

Activation of logfile generation slows down the calculation speed of the instrument. Enable this function only if logfiles are explicitly requested.

### General Workflow

To enable the generation of logfiles proceed as follow:

1. In the "EUTRA/LTE > Logfile Generation > Output Path" dialog, select the network directory the logfiles are saved to, e.g. `/var/user/temp/logfiles` and select a "Logging File Preamble", e.g. *201008Log*.

   **Note:** The network directory should be empty. Existing logfiles are overwritten.
   It is recommended to use different preambles to assure that previous logfiles are not lost.

2. If required, enable "Extended DCI/UCI Logging".

3. Select the processing chain points for that logfiles are to be generated, e.g. "Point 3: Channel Coding".

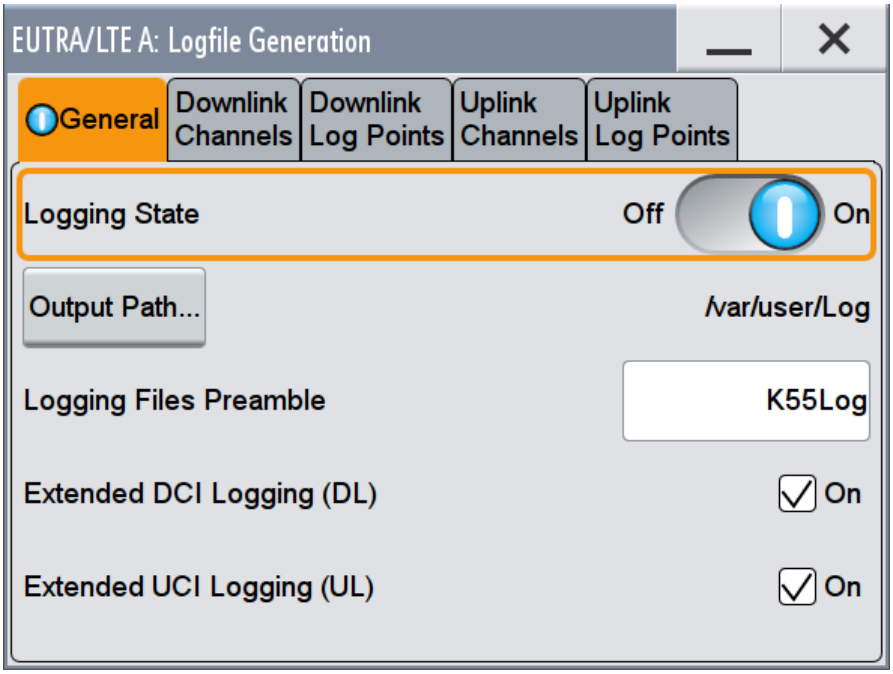
   **Tip:** Not all of the available logging point are relevant for all channels. The processing of the PBCH for instance does not include the step "Code block segmentation / CRC", i.e. even if the Logging Point "Point 2: Code block segmentation / CRC" is enabled, no logfile is generated (see table 7-1).
   No logfiles are generated also in case that the corresponding processing step is disabled in the EUTRA/LTE dialog. For example, if channel coding and/or scrambling are disabled for some channel, no logfiles for the Point 3 and/or Point 6/Point 8 are available for this channel as long as these processing steps are not enabled.

4. Set the "Logging State" to On to enable logfile generation.

5. Adjust the EUTRA/LTE Settings as required and enable signal generation.

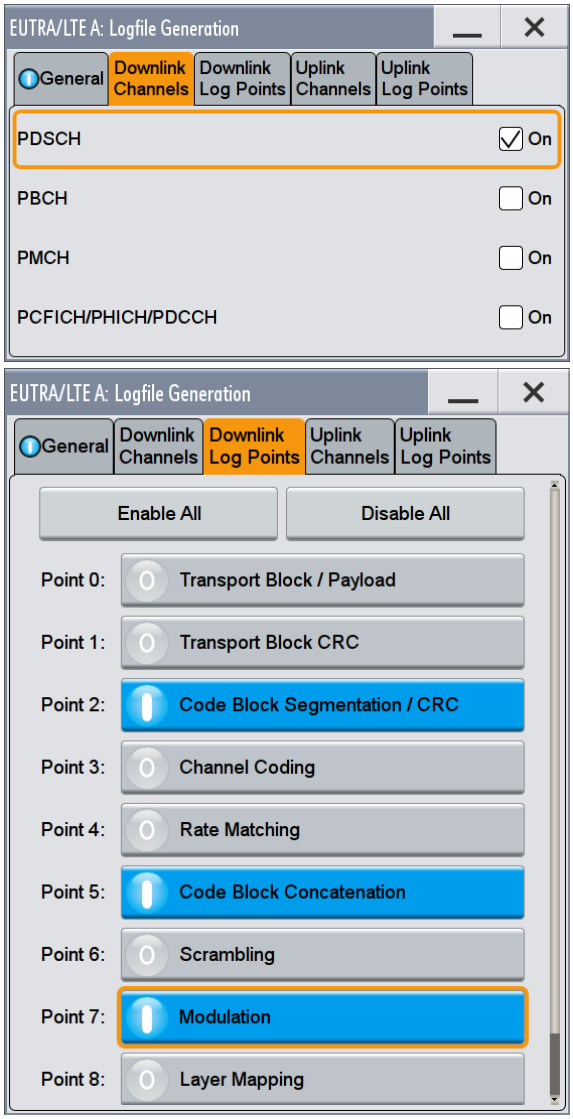
### 7.8.4 Logfile Generation Settings

► To access this dialog, select "EUTRA/LTE > General > Logfile Generation".

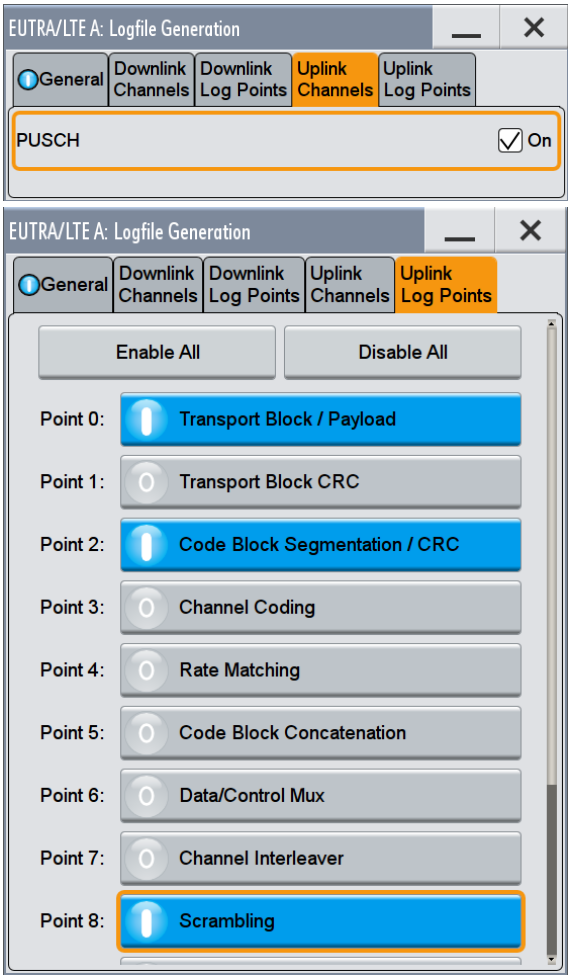



The dialog is divided into several tabs. The general tab comprises the settings necessary to enable the logfile generation and configure the output file. The further tabs group the settings to define the different channels to be logged and the logging point(s) for which logfiles will be generated.

**Downlink Settings**




**Uplink Settings**




**Logging State**
Enables/disables logfile generation.

**Note:** Activation of logfile generation slows down the calculation speed of the instrument. Enable this function only if logfiles are explicitly requested.

See also chapter 7.8.3, "Working with the Logfile Generation Functionality", on page 100.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:LOGGen:STATe` on page 537

**Output Path**
Selects the network directory the logged files are stored in.

Remote command:
[:SOURce<hw>]:BB:EUTRa:LOGGen:OUTPut on page 538

**Logging Files Preamble**
An optional preamble may be added to the file name. Refer to chapter 7.8.2.1, "File Names", on page 93 for a description of the file naming convention used.

Remote command:
[:SOURce<hw>]:BB:EUTRa:LOGGen:LFP on page 538

**Extended DCI/UCI Logging**
Enables the generation of a logfile with extended information regarding the DCI/UCI mapping.

For description of the content of the generated file, see "Extended DCI Logfile" on page 97 and respectively "Extended UCI Logfile" on page 99.

Remote command:
[:SOURce<hw>]:BB:EUTRa:LOGGen:DL:EDLogging on page 538
[:SOURce<hw>]:BB:EUTRa:LOGGen:UL:EULogging on page 538

**Physical Channels**
Selects the channel for which logfiles are generated.

Remote command:
[:SOURce<hw>]:BB:EUTRa:LOGGen:DL:ENCC on page 539
[:SOURce<hw>]:BB:EUTRa:LOGGen:DL:PBCH on page 539
[:SOURce<hw>]:BB:EUTRa:LOGGen:DL:PDSCh on page 539
[:SOURce<hw>]:BB:EUTRa:LOGGen:DL:PMCH on page 539
[:SOURce<hw>]:BB:EUTRa:LOGGen:UL:PUSCh on page 539

**Enable/Disable All**
Enables/disables all logging points.

Remote command:
[:SOURce<hw>]:BB:EUTRa:LOGGen:DL:EALL on page 538
[:SOURce<hw>]:BB:EUTRa:LOGGen:DL:DALL on page 538
[:SOURce<hw>]:BB:EUTRa:LOGGen:UL:EALL on page 538
[:SOURce<hw>]:BB:EUTRa:LOGGen:UL:DALL on page 538

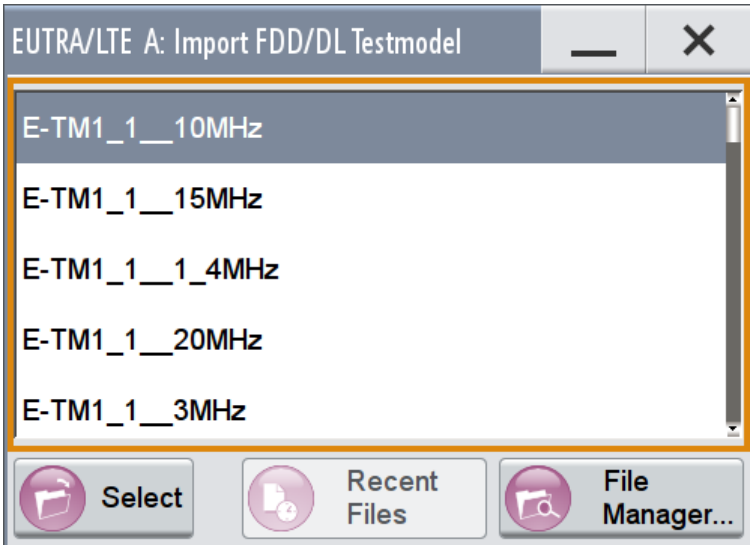
**Logging Point**
Enables/disables one particular logging point.

Refer to chapter 7.8.1, "Signal Processing Chains and Logging Points", on page 90 for description on the available logging points.

Remote command:
[:SOURce<hw>]:BB:EUTRa:LOGGen:DL:LOGPoint<ch0> on page 539
[:SOURce<hw>]:BB:EUTRa:LOGGen:UL:LOGPoint<ch0> on page 539

# 7.9 Test Setups/Models

► To access this dialog, select "General > Test Setups/Models".




The dialog offers quick selection and settings adjustment according to one of the various EUTRA Test Models (E-TM) as defined in the 3GPP specification TS 36.141. The EUTRA Test Models are defined for FDD and TDD duplexing mode.

**EUTRA Test Models (E-TM) Downlink**
Access a list of EUTRA Test Models (E-TM) in accordance with the 3GPP standard TS 36.141.

The DL test models are predefined configurations of LTE settings. Three main groups of test models are defined, the E-TM1, E-TM2 and E-TM3. All test models use the following parameters:

- single antenna port, single code word, single layer and no precoding
- duration of one frame
- normal cyclic prefix
- localized virtual resource blocks, no intra-subframe hopping for PDSCH
- UE-specific reference signals are not used

The data content of the physical channels and signals are defined in the 3GPP specification. Each E-TM is defined for six different channel bandwidths, 1.4/3/5/10/15 and 20MHz. The test models are defined for specific test purpose (see table 7-5).

***Table 7-5: E-TM available for selection***

| EUTRA Test Model | Defined for tests on |
|---|---|
| E-TM1.1 | • BS output power<br>• Unwanted emissions<br>• Transmitter intermodulation<br>• RS absolute accuracy |
| E-TM1.2 | • ACLR<br>• Operating band unwanted emissions |

| EUTRA Test Model | Defined for tests on |
|---|---|
| E-TM2 | • Total power dynamic range (lower OFDM symbol power limit at min power)<br>• EVM of single 64QAM PRB allocation (at min power)<br>• Frequency error (at min power) |
| E-TM3.1 | • Output power dynamics<br>• Transmitted signal quality (Frequency error and EVM for 64QAM modulation, at max power) |
| E-TM3.2 | Transmitted signal quality:<br>• Frequency error<br>• EVM for 16QAM modulation |
| E-TM3.3 | Transmitted signal quality:<br>• Frequency error<br>• EVM for QPSK modulation |

Remote command:
`[:SOURce<hw>]:BB:EUTRa:SETTing:TMOD:DL` on page 372
`[:SOURce<hw>]:BB:EUTRa:SETTing:TMOD:TDD` on page 372

## 7.10 General DL Settings / General TDD DL Settings

The "General DL Settings" dialog allows you to configure the EUTRA/LTE system for transmission direction downlink, i.e. the signal of one BS or one cell.

1. To access this dialog, select "General > Link Direction > Downlink (OFDMA)"
2. Select "General DL Settings".

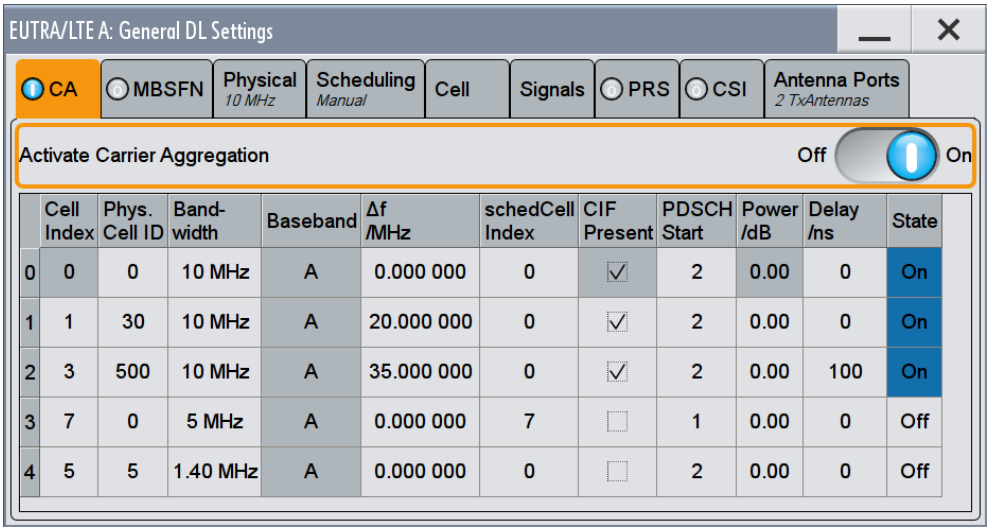
   The EUTRA/LTE standard defines no differences between TDD and FDD signals on the physical layer if only one link direction is considered at once and the "General TDD DL Settings" dialog comprises the same parameters as the "General DL Settings" dialog but is extended with the TDD Frame Structure Settings tab.
   The "General DL Settings" dialog consists of several sections:


- DL Carrier Aggregation Configuration....107
- MBSFN Settings....115
- Physical Settings....128
- Scheduling Settings....130
- Cell Specific Settings....131
- TDD Frame Structure Settings....135
- Downlink Signals Settings....136
- Positioning Reference Signal (PRS) Settings....137
- CSI Settings....140
- Antenna Ports Settings....144

### 7.10.1 DL Carrier Aggregation Configuration

Carrier Aggregation is an LTE-A (LTE Rel 10) feature enabled for instruments equipped with software option R&S SMW-K85.

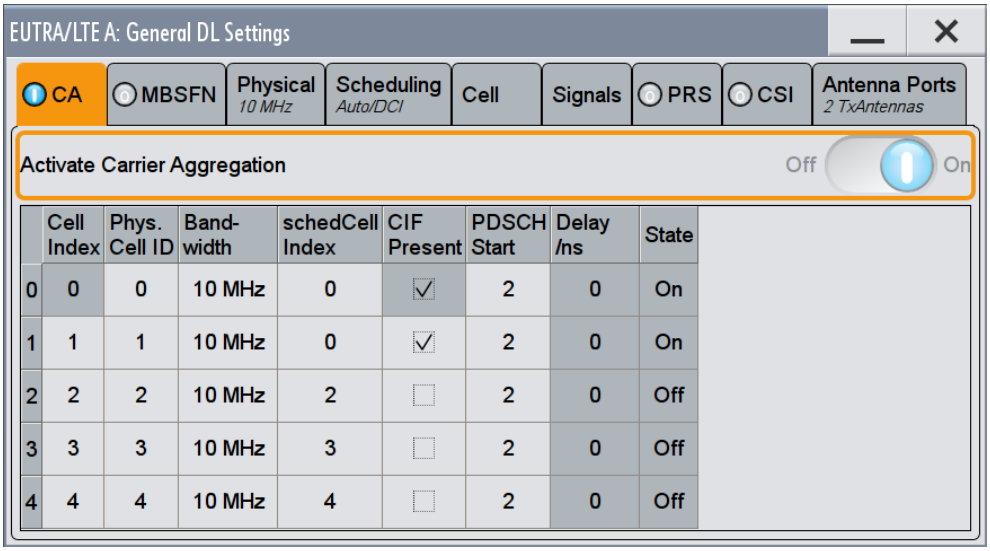
1. To access this dialog select "General > Link Direction > Downlink (OFDMA)".
2. Select "General DL Settings > CA".




| | Cell Index | Phys. Cell ID | Band-width | Baseband | Δf /MHz | schedCell Index | CIF Present | PDSCH Start | Power /dB | Delay /ns | State |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 10 MHz | A | 0.000 000 | 0 | ☑ | 2 | 0.00 | 0 | On |
| 1 | 1 | 30 | 10 MHz | A | 20.000 000 | 0 | ☑ | 2 | 0.00 | 0 | On |
| 2 | 3 | 500 | 10 MHz | A | 35.000 000 | 0 | ☑ | 2 | 0.00 | 100 | On |
| 3 | 7 | 0 | 5 MHz | A | 0.000 000 | 7 | ☐ | 1 | 0.00 | 0 | Off |
| 4 | 5 | 5 | 1.40 MHz | A | 0.000 000 | 0 | ☐ | 2 | 0.00 | 0 | Off |

***Fig. 7-6: "General DL Settings > Carrier Aggregation" dialog in "System Config > Fading and Baseband Configuration > BB Source Config > Separate Sources"***

The "DL Carrier Aggregation Configuration" dialog provides the settings for the configuration of one primary cell (PCell) and up to four secondary cells (SCell). In real system, the RRC messages signal all the relevant system information for a certain SCell. In this implementation, all relevant and configurable SCell settings are grouped in the "DL Carrier Aggregation" dialog. The remaining cell-specific settings are identical for all component carriers.
The available settings depend on the current "System Configuration" settings, in particular on the selected "BB Source Config".




| | Cell Index | Phys. Cell ID | Band-width | schedCell Index | CIF Present | PDSCH Start | Delay /ns | State |
|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 10 MHz | 0 | ✓ | 2 | 0 | On |
| 1 | 1 | 1 | 10 MHz | 0 | ✓ | 2 | 0 | On |
| 2 | 2 | 2 | 10 MHz | 2 | | 2 | 0 | Off |
| 3 | 3 | 3 | 10 MHz | 3 | | 2 | 0 | Off |
| 4 | 4 | 4 | 10 MHz | 4 | | 2 | 0 | Off |

*Fig. 7-7: "General DL Settings > Carrier Aggregation" dialog in "System Config > Fading and Baseband Configuration > BB Source Config > Coupled Sources"*

### SCell settings derivation

The settings of each SCell are calculated automatically form the configured PCell settings and depending on the parameters in the "DL Carrier Aggregation Configuration" dialog. The following list provides an overview of the restrictions and interdependencies between related parameters if DL Carrier Aggregation is enabled:

- Combination of FDD and TDD is not possible.
- Simultaneous support of LTE and LTE-A users is provided (see User Configuration Settings > Activate CA).
- The following settings in the PCell are not allowed:
  – "Channel Bandwidth = User"
  – "PDSCH Scheduling = Auto/DCI"
- To enable cross-carrier scheduling, the DCI formats are extended to support the CIF field. The DCIs have to be configured individually per component carrier.
  In this firmware version, the "Auto/DCI" mode is always disabled and the component carriers of the SCells use the same frame configuration as the PCell.
  Support of cross-carrier scheduling in "Auto/DCI" mode will be available in future version.
- The "Control Region for PDCCH" of all component carrier/SCells is set to the same value, unless the 3GPP standard specifies a specific value, e.g. in special subframes in TDD mode.
  The PHICH Duration of the SCells is adjusted automatically if required, i.e. if this parameter is set to "Extended" in the PCell, the SCell are generated with extended PHICH duration even if the "PDCCH Start" is not set properly for the SCell.
  However, the PHICH Duration in a SCell will be adjusted if the selected narrow channel bandwidth in this SCell leads to not sufficient amount of PDCCH symbols. Consequently, different channel bandwidth results in different Number of available CCEs (PDCCH).

- The parameter Number of PHICH Groups may have different values in the SCells, because it is calculated based on the parameter "N_g".
- If a SCell spans channel bandwidth with less RBs than the PCell, the instrument ignores the allocations or part of the them that is outside the channel bandwidth.

**Limitation in the maximum LTE-A bandwidth**

The LTE specification defines a maximumChannel Bandwidth of 20MHz and aggregation of up to five component carriers to achieve 100MHz bandwidth.

The R&S SMW configured to generate more than one component carrier per baseband automatically applies the multi carrier function. In this case, the maximum bandwidth of the generated LTE-A signal is restricted by the instrument's hardware.

Using the maximum sampling rate, the R&S SMW equipped with the options R&S SMW-B10/K522 can internally generate multi carrier signals with up to 160 MHz RF bandwidth.

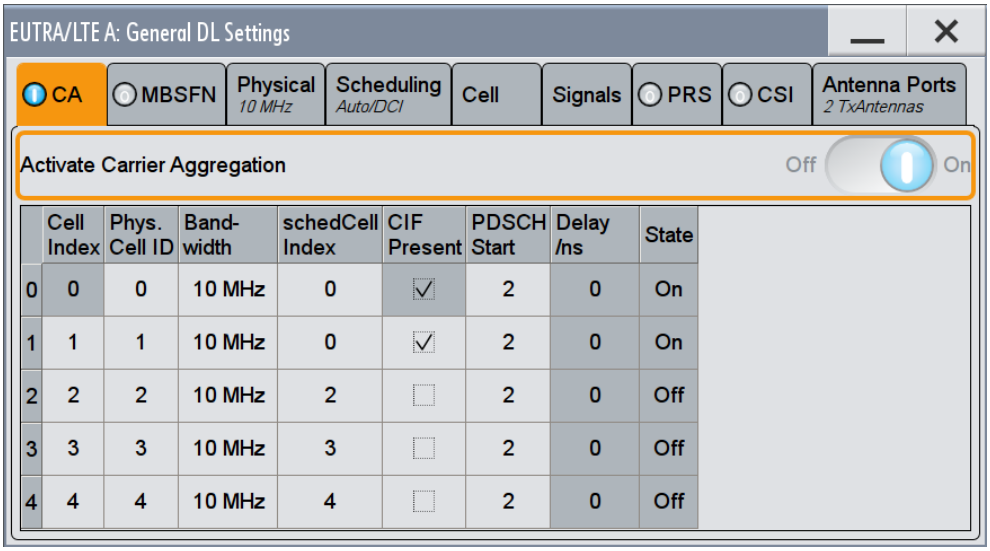
In this description, the terms cell and component carrier (CC) are used interchangeably.

**Example: Enabling Carrier Aggregation and Cross-Carrier Scheduling in Coupled Mode**

The instrument generates the required signal in system configuration with *coupled* baseband sources.

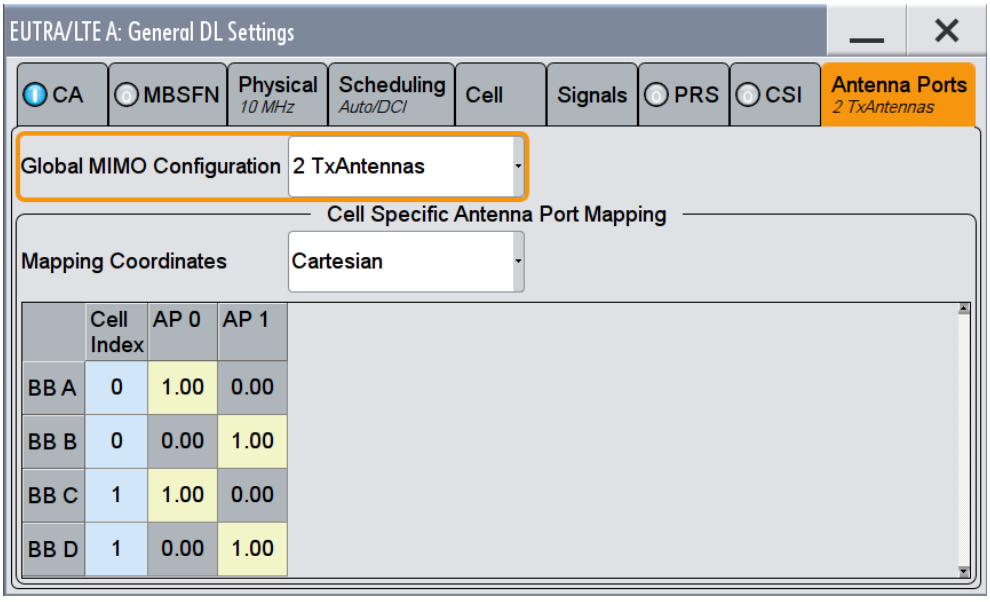
1. Select "System Config > Fading and Baseband Configuration > Mode > Advanced"
2. Enable a suitable LxMxN configuration, for example:
   a) For a LTE-A carrier aggregation scenario without MIMO, enable a 2x1x1 configuration, i.e. "Entities = 2", "Basebands = 1", "Streams = 1"
   b) For a LTE-A carrier aggregation scenario with 2x2 MIMO each component carrier, enable a 2x2x2 configuration, i.e. "Entities = 2", "Basebands = 2", "Streams = 2"
3. Select "BB Source Config > Coupled Sources" and select "Apply".
4. For intra-band 2x2x2 scenario, select "System Config > I/Q Stream Mapping" and route the streams A and C to RF A and streams B and B to RF B respectively.
5. Select "Baseband > EUTRA/LTE".
6. Select "General DL Settings > Scheduling > PDSCH Scheduling > Auto/DCI".
7. Select "General DL Settings > CA".

   The "Activate Carrier Aggregation > ON" parameter confirms that carrier aggregation is enabled automatically. Activated are two component carrier with 10 MHz bandwidth each.




8. To enable cross-carrier scheduling for the second component carrier/SCell:
   a) set the "schedCell Index = 0"
      The component carrier SCell#1 can be cross-scheduled over the PCell
   b) enable the "CIF Present" parameter
      The component carrier SCell#1 will be cross-scheduled over the PCell.

9. Select "General DL Settings > Antenna Ports" to verify the configured "Cell Index" per Baseband (BB) configuration.



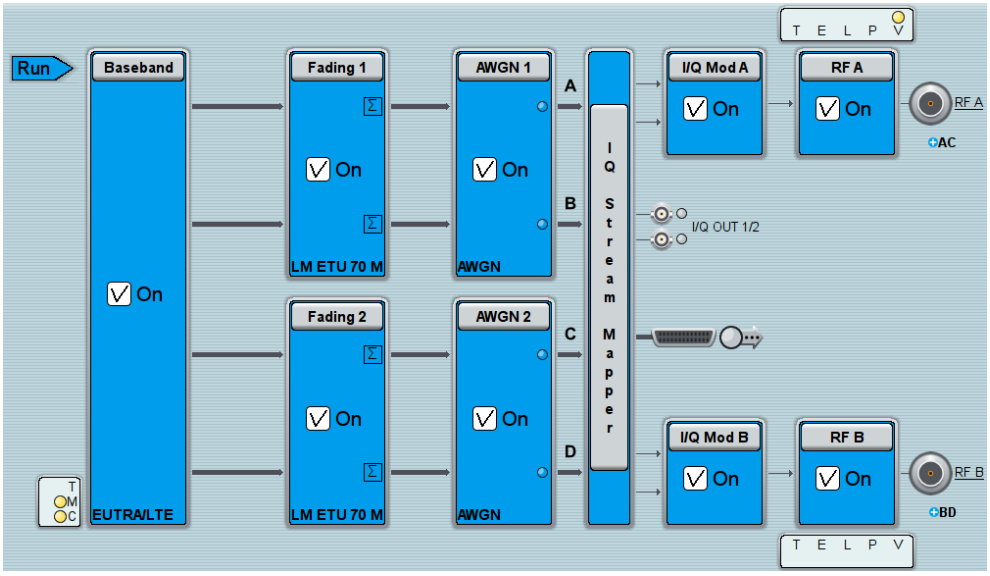

10. Select "EUTRA/LTE > DL Frame Configuration > PDCCH" and configure the settings, for example:
    a) In "Subframe#0", select "Append" to add a second row in the DCI table.
    b) Set the same "Cell Index = 0" to enable cross-carrier scheduling.
    c) Set the "DCI Format", e.g. select "DCI Format = 2" for the 2x2x2 configuration.

d) Select "Content > Config" and adjust the settings for the component carriers as required, e.g. set the "Carrier Indicator Field = 0" for the PCell and to 1 in the SCell.

| | User | UE_ID n_RNTI | Cell Index | DCI Format | Search Space | Content | PDCCH Format | Number CCEs | CCE Index | No.Dummy CCEs | Conflict |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | User1 | 0 | 0 | 2 | Auto | Config... | 0 | 1 | 0 | 0 | |
| 1 | User1 | 0 | 0 | 2 | Auto | Config... | 0 | 1 | 1 | 24 | |

e) Use the "Copy/Paste" function and fill the subframes with the settings of subframe#0.

11. Select "DL Frame Configuration > Time Plan" and compare the configuration of both cells (use the parameter "Cell index = 0" and "Cell Index = 1").
12. Select "EUTRA/LTE State > ON".
13. If required, use the Fading Simulator to configure the propagation conditions.
14. Adjust the RF frequency of both RF outputs.
15. Activate the RF outputs.



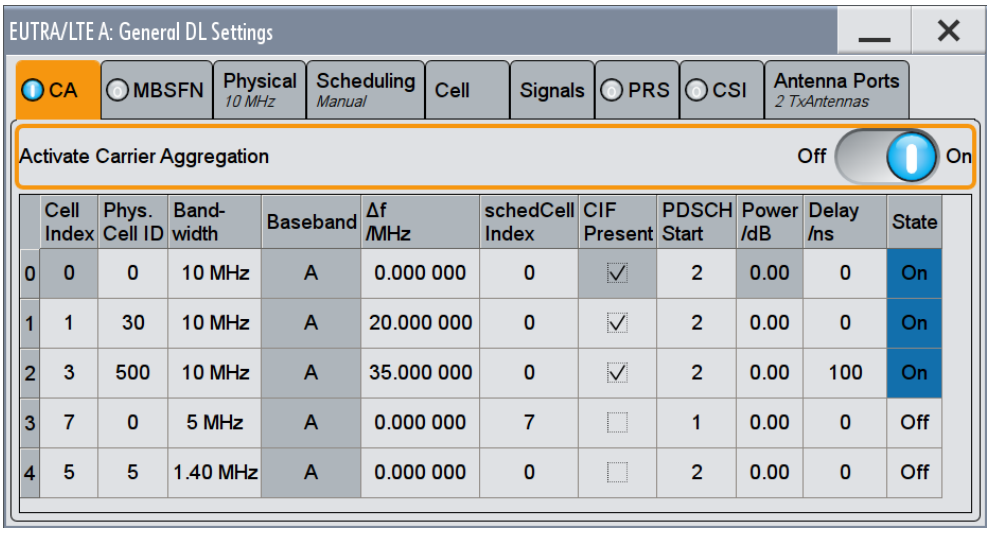

**Example: Enabling Carrier Aggregation and Cross-Carrier Scheduling**

**Tip:** In the following, a general example is provided. Only the related settings are discussed.

The instrument generates the required signal in system configuration with separate baseband sources.

1. Select "System Config > Fading and Baseband Configuration > BB Source Config > Separate Sources"
2. Select "Baseband Block A > EUTRA/LTE" and configure the settings of the PCell as required, e.g. select one of the predefined "Test Setups/Models".

3. To enable carrier aggregation:
   a) select "General DL Settings > DL Carrier Aggregation Configuration > Activate Carrier Aggregation > ON"
   b) select "DL Frame Configuration > Configure User" and enable/disable "Activate CA" per user as required.
4. In the "General DL Settings > DL Carrier Aggregation Configuration > Component Carrier Table" configure the settings of the SCells (see example on the following figure).




| | Cell Index | Phys. Cell ID | Band-width | Baseband | Δf /MHz | schedCell Index | CIF Present | PDSCH Start | Power /dB | Delay /ns | State |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 10 MHz | A | 0.000 000 | 0 | ☑ | 2 | 0.00 | 0 | On |
| 1 | 1 | 30 | 10 MHz | A | 20.000 000 | 0 | ☑ | 2 | 0.00 | 0 | On |
| 2 | 3 | 500 | 10 MHz | A | 35.000 000 | 0 | ☑ | 2 | 0.00 | 100 | On |
| 3 | 7 | 0 | 5 MHz | A | 0.000 000 | 7 | ☐ | 1 | 0.00 | 0 | Off |
| 4 | 5 | 5 | 1.40 MHz | A | 0.000 000 | 0 | ☐ | 2 | 0.00 | 0 | Off |

5. To enable cross-carrier scheduling for a certain component carrier/SCell:
   a) set the "DL Carrier Aggregation Configuration > schedCell Index" of this component carrier/cell to 0
   In the example, the component carriers SCell#1, SCell#2 and SCell#4 can be cross-scheduled over the PCell
   b) enable the "DL Carrier Aggregation Configuration > CIF Present" parameter.
   In this example, the component carriers SCell#1 and SCell#2 will be cross-scheduled over the PCell.
   c) To enable a component carrier/SCell, set "DL Carrier Aggregation Configuration > State > ON".
6. Enable LTE signal generation "EUTRA/LTE State > ON".
7. If required, use the Fading Simulator to configure the propagation conditions.
8. If required, adjust the RF frequency of path A to the middle frequency of the resulting total signal bandwidth.
9. Activate the RF output.

   The instrument will generate the signal in the path A as multi carrier signal, composed of three carrier, the PCell, the SCell#1 and SCell#2. Each of these component carrier spans "Channel Bandwidth" = 10MHz and the SCells use carrier frequency offset with 20MHz and 35MHz respectively.
   The SCell#4 is disabled.

Provided are the following settings:

**Activate Carrier Aggregation**
Enables/disables the generation of several component carriers.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CA:STATe` on page 447

**Component Carrier Table**
The table provides the settings of the component carriers. The first row displays the settings of the PCell as configured in the "General DL Settings" dialog. The following four rows provide the configurable settings of the up to four SCells.

**Cell Index ← Component Carrier Table**
Sets the cell index of the corresponding SCell, as specified in 36.331 [16]. The SCell Index is required for signaling on the DCI DCI Format Configuration field.

The cell index of the PCell is always 0.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:INDex` on page 449

**Physical Cell ID ← Component Carrier Table**
Sets the physical Cell ID of the corresponding SCell. The physical Cell ID of the PCell is set by the parameter "General DL Settings > Cell ID".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:ID` on page 448

**Bandwidth ← Component Carrier Table**
Sets the bandwidth of the corresponding component carrier/SCell.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:BW` on page 447

**Baseband ← Component Carrier Table**
In "Systrem Configuration > BB Source Config > Separate Sources", displays the baseband block that generates the selected component carrier. The LTE-A signal is generated as multi carrier waveform by one baseband.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:BB` on page 447

**delta f / MHz ← Component Carrier Table**
(enabled in "Systrem Configuration > BB Source Config > Separate Sources" configuration)

Sets the frequency offset between the central frequency of corresponding SCell and the frequency of the PCell.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:DFReq` on page 448

**CIF Present ← Component Carrier Table**
Defines whether theDCI Format ConfigurationCarrier Indicator Field (CIF) is included in the PDCCH DCI formats transmitted from the corresponding SCell.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:CIF` on page 448

**schedCell Index ← Component Carrier Table**
Defines the component carrier/cell that signals the UL and DL grants for the selected SCell. The signaling cell is determined by its Cell Index.

According to the LTE-A specification, cross-carrier scheduling has to be enabled per user and per component carrier.

To enable signaling for one particular SCell on the PCell, i.e. cross-carrier scheduling, set the "schedCell Index" to 0.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:SCINdex` on page 449

**PDSCH Start ← Component Carrier Table**
Sets the starting symbol of the PDSCH for the corresponding SCell, i.e. determines the "Control Region for PDCCH".

**Note:** All subframes use the same "Control region for PDCCH" as set here, regardless of the settings of the PCell.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:PSTart` on page 449

**Power / dB ← Component Carrier Table**
(enabled in "Systrem Configuration > BB Source Config > Separate Sources" configuration)

Sets the RS EPRE (Reference Signal Energy per Resource Element) of the according SCell relative to the RS EPRE of the PCell.

The absolute power of the RS of a cell is calculated according to the follwoing formula:

$Absolute\_RS\_EPRE_{Cell\_X}$ = RS Power per RE relative to Level Display + "Level Display" + $CA\_Power_{Cell\_X}$

**Example:**

Set "EUTRA/LTE > Set to Default"

Set Activate Carrier Aggregation > ON

For the SCell1, set $CA\_Power_{Cell\_1}$ = Power / dB = -5dB

Enable SCell1, i.e. set State > ON

The value of the parameter "General DL Settings > RS Power per RE relative to Level Display" is -30.736 dB

The power displayed in the header of the instrument is "Level = -30 dBm"

$Absolute\_RS\_EPRE_{Cell\_1}$ = (-30.736dB) + (-30.00dBm) + (-5dB) = -65.736dBm

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:POFFset` on page 449

**Delay / ns ← Component Carrier Table**
(enabled in "Systrem Configuration > BB Source Config > Separate Sources" configuration)

Sets the time delay of the SCell relative to the PCell.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:TDELay` on page 450

**State ← Component Carrier Table**
Activates/deactivates the component carrier/SCell.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:STATe` on page 450

### 7.10.2 MBSFN Settings

Configuration of the "MBSFN Settings" requires the additional software option R&S SMW-K84.

The "MBSFN Settings" section comprises the parameters necessary to configure a MBSFN transmission. Refer to chapter 3.5, "LTE MBMS Concepts", on page 39 for background information.

According to the MBMS LTE concept, one eNodeB may serve more than one MBSFN areas. In this implementation, the simulated cell belongs to only one MBSFN areas. Hence, all radio resources reserved for MBSFN subframes are assigned to one MBSFN area.

In a LTE network, the MBSFN information is transmitted only during the specially reserved MBSFN subframes. Almost all MBMS control information is carried by a special control channel, the MCCH. There is one MCCH per MBSFN area. In this implementation, the

MCCH is always mapped to the first active MBSFN subframe within one MCCH repetition period (see figure in example "MBSFN Resource Allocation" on page 118).

A configurable "MCCH repetition period" determines how frequent the control information is transmitted within a defined "MCCH modification period" (see figure below).

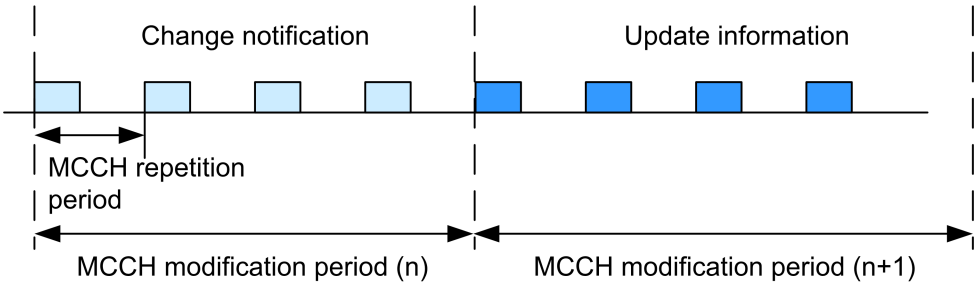



***Fig. 7-8: Change of MCCH information***

The MCCH carries a single message, the *MBSFNAreaConfiguration* message, which provides information on the ongoing MBMS sessions and the corresponding radio resources, i.e. the mapping of the PMCHs. The BCCH also carries some of the MBMS control information by means of the special System Information Blocks SIB Type 13 and SIB Type 2.

For exact definition of control elements and messages such as *MBSFNAreaConfiguration*, please refer to 3GPP TS 36.311, v9.6.0. [16].

The following table provides an overview of the steps an UE performs to acquire the information about the resource configuration of reserved MBSFN subframes, the position of the MCCH within the MBSFN subframes as well as information necessary to demodulate the MCCH and to retrieve the information about the PMCH scheduling.

***Table 7-6: Acquiring MBSFN information***

| Step | Information provided by | Description | User Interface |
|---|---|---|---|
| 1 | BCCH > SIB#2<br>• *MBSFN-SubframeConfiguration* | The SIB#2 contains common radio configuration information and among other things a list (*mbsfn_SubframeConfigList*) with scheduling information for up to 8 MBSFN allocations (*MBSFN-SubframeConfiguration*).<br>Hence, after receiving the SIB#2 each UE, also the MBSFN incapable UEs, are informed about the subframes that are reserved for MBSFN in the downlink. | Subframe Config (SIB Type 2) |
| 2 | BCCH > SIB#13<br>• *MBSFN-AreaInfoList*<br>• *MBMS-NotificationConfiguration* | The SIB#13 carries the information necessary to acquire the MBMS control information for up to 8 MBSFN areas (*MBSFN-AreaInfoList*), as well as the common MBMS notification scheduling information (*MBMS-NotificationConfiguration*).<br>After receiving the SIB#13 the MBSFN capable UE is able to find the MBSFN reference signals (*mbsfn-AreaID*) and to detect and demodulate the MCCH (*mcch-Config* and *MBMS-Notification-Configuration*). | MBSFN-AreaInfoList Parameters<br>MBSFN-Notification-Config Parameters |

| Step | Information provided by | Description | User Interface |
|---|---|---|---|
| 3 | MCCH > *MBSFNAreaConfiguration*<br>• *PMCH-InfoList*<br>• *CommonSF-Allocation-PatternList* | The MCCH carries the single message *MBSFNAreaConfiguration* that determines which of the reserved MBSFN subframes (compare SIB#2) belong to which MBSFN area and provides a list with configuration information for up to 15 PMCHs (*PMCH-InfoList*) per an MBSFN area.<br>**Note:**The *MBSFN-SubframeConfiguration* is equivalent to the summary of all *CommonSF-AllocationPatternList*. In this implementation, all MBSFN subframes are assigned to one MBSFN area. Hence, *MBSFN-SubframeConfiguration* equates the *CommonSF-AllocationPatternList* and configuration of the later one is done with the parameters of SIB#2.<br>The *PMCH-InfoList* specifies the individual PMCHs, including MBMS sessions, used MCS, allocated subframes (*sf-AllocEnd*) and the periodicity for providing MCH scheduling information on MAC layer (*mch-SchedulingPeriod*). | Common Subframe Allocation Period<br>PMCH-InfoList Parameters |
| 4 | PMCH | The UE receives the PMCHs. | |

The following figures show the signaling of MBSFN information during the acquisition steps.

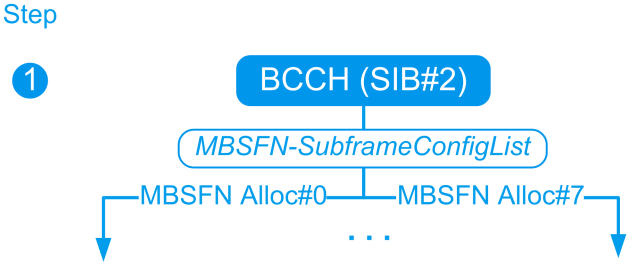



***Fig. 7-9: MBSFN Signaling (step 1)***

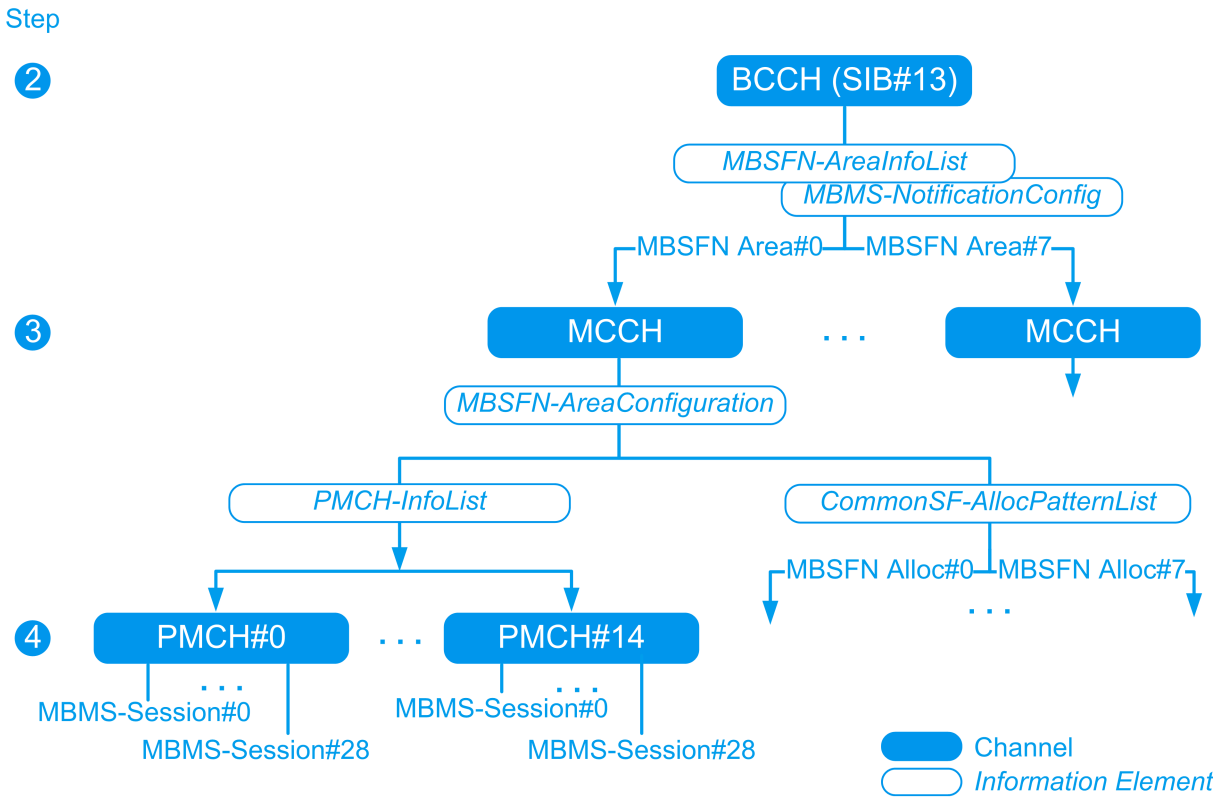



*Fig. 7-10: MBSFN Signaling (steps 2 to 4)*

### Example: MBSFN Resource Allocation

This example shows the MBSFN resource allocation for the settings listed in the following table. Use the default values for the other parameters.

**ARB Sequence Length**

The generation of a signal with cyclically repeating MBSFN pattern requires an "ARB sequence length" equal to the "MCCH repetition period" or to the "MCCH modification period".

The maximum value of the ARB sequence length depends on the selected channel bandwidth and on the memory size option of the generator.

| Parameter | Value |
|---|---|
| EUTRA/LTE > Duplexing | FDD |
| EUTRA/LTE > Sequence Length | 512 Frames |
| General DL Settings > Channel Bandwidth | 1.4 MHz |
| General DL Settings > MBSFN Mode | Mixed |
| Radio Frame Allocation Period | 8 Frames |
| Radio Frame Allocation Offset | 2 Frames |

| Parameter | Value |
|---|---|
| Subframe Allocation Mode | 4 Frames |
| Allocation value (HEX) | AAAAAA |
| MCCH State | On |
| MCCH Repetition Period | 128 Frames |
| MCCH Modification Period | 512 frames |
| Notification Repetition Coefficient | 2 Frames |
| Notification Subframe Index | 4, i.e. the MCCH change notification on PDCCH is transmitted on subframe#6 |
| Common Subframe Allocation Period | 64 Frames, i.e. the PMCH scheduling is repeated after 64 frames |
| Number of PMCHs | 3 |
| PMCH#0: SF Alloc Start/SF Alloc EndSF Alloc End | 5 |
| PMCH#0: MCH Scheduling Period | 8 |
| PMCH#1: SF Alloc End | 7 |
| PMCH#1: MCH Sched. Period | 8 |
| PMCH#2: SF Alloc End | 95 (automatically calculated) |
| PMCH#2: MCH Sched. Period | 8 |

The following figure shows the resource allocation.

SFN is the System Frame Number. By default, the SFN starts with 0 by the start value can be adjusted with the parameter SFN Offset.

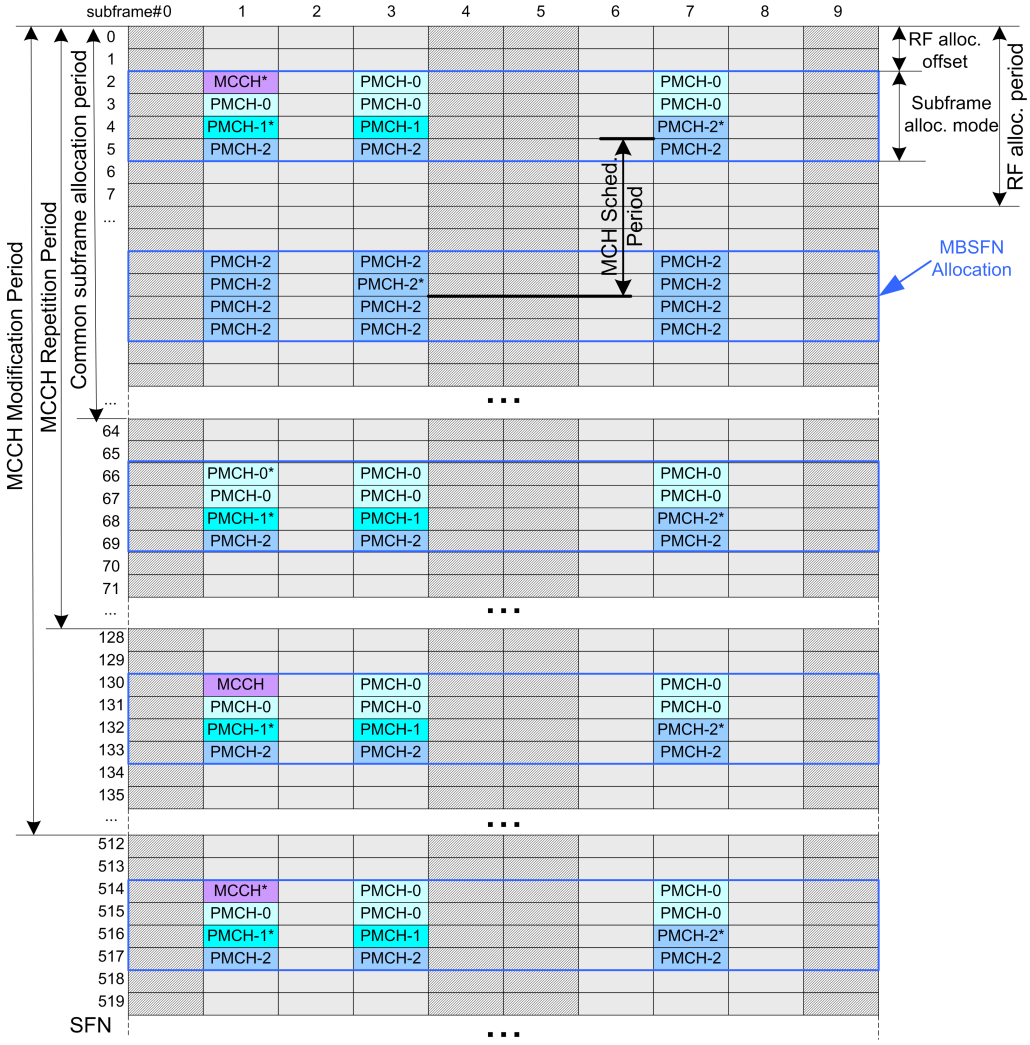


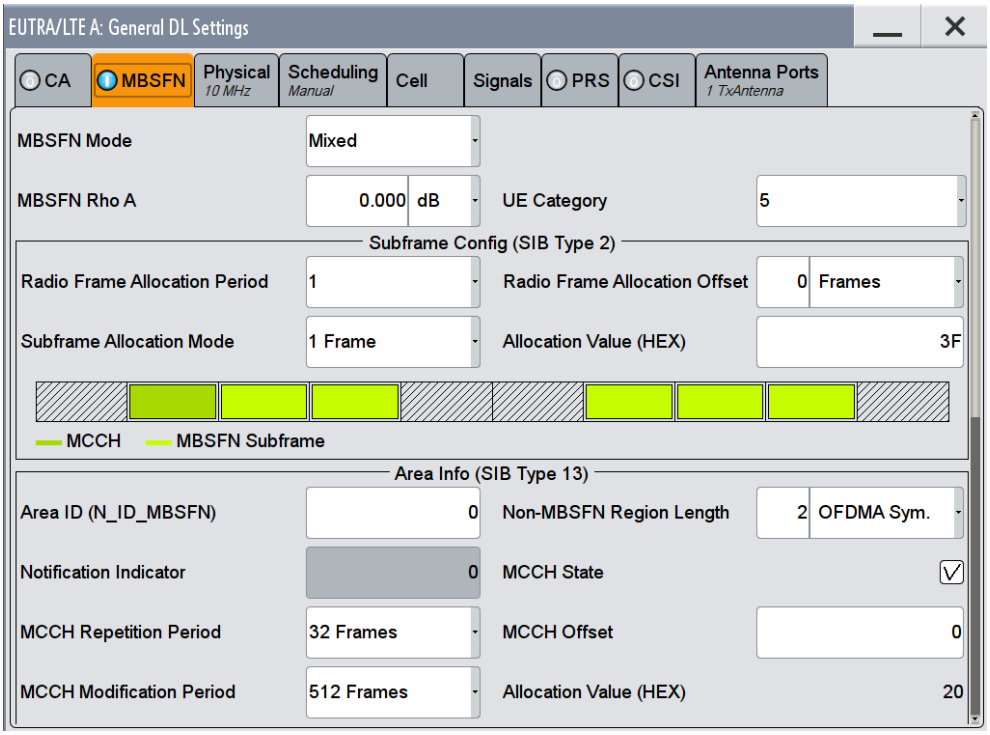

***Fig. 7-11: Example of MBSFN resource allocation***

| | |
|---|---|
| Pattern subframes | = Subframes not allowed to be scheduled as MBSFN subframes |
| Grey subframes | = MBSFN subframes not used for MBMS transmission, i.e. regular LTE subframes that can be used for allocation of DL signal |
| MCCH* | = First MCCH in a new MCCH modification period |
| PMCH-0*/PMCH-1*/PMCH-2* | = First PMCH of one MCH scheduling period. |

If PRS and MBSFN is configured to be in the same subframe, MBSFN is skipped and PRS is transmitted solely (see example "Overlapping PDSCH, PRS and MBSFN" on page 139).

1. To access the MBSFN dialog, select "General > Link Direction > Downlink (OFDMA)".

2. Select "General DL Settings > MBSFN".




This dialog comprises the parameters necessary to configure a MBSFN transmission..

Provided are the following settings:

**MBSFN Mode**
Enables the MBSFN transmission and selects a mixed MBSFN Mode, i.e. the available subframes are shared between MBSFN and regular LTE operation.

**Note:** Dedicated MBSFN Mode (i.e. all subframes are used for MBSFN solely) will be supported in a later version.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:MODE` on page 443

**MBSFN Rho A**
Defines the power of the MBSFN channels relative to the common Reference Signals.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:RHOA` on page 445

**UE Category**
Defines the UE category as defined in 3GPP TS 36.306.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:UEC` on page 446

**Subframe Config (SIB Type 2)**
This section comprises settings for configuration of the general MBSFN structure, i.e. it defines which subframes are used for MBSFN transmission. In the “real” system, these values are transmitted via the System Information Block (SIB) Type 2.

The parameters in this section correspond to the MBMS information element *MBSFN-SubframeConfig*, as defined in [16].

The graph in this section displays the currently reserved MBSFN subfames. To select a subframe as MBSFN subframe, click on this subframe.

**Note:** The here described parameters are for configuration of the MBSFN structure only, the coding of the SIB#2 and the SIB#13 is not done automatically.
Also, the content of the MCCH is not generated automatically, but has to be set manually by means of an according data source.

**Radio Frame Allocation Period ← Subframe Config (SIB Type 2)**
Radio-frames that contain MBSFN subframes occur when the following equation is satisfied:

```
SFN mod radioFrameAllocationPeriod = radioFrameAllocationOffset
```

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:SC:APER` on page 446

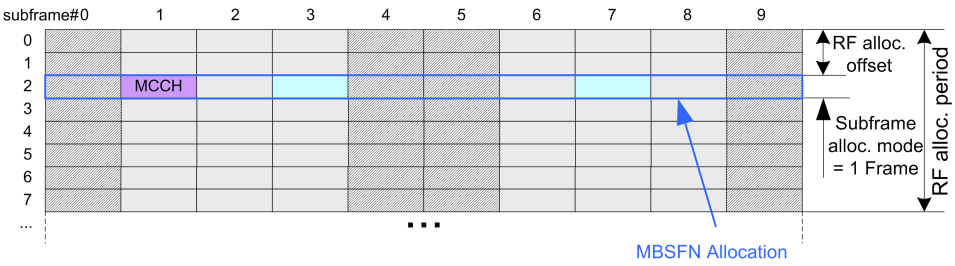
**Radio Frame Allocation Offset ← Subframe Config (SIB Type 2)**
Radio-frames that contain MBSFN subframes occur when the following equation is satisfied:

```
SFN mod radioFrameAllocationPeriod = radioFrameAllocationOffset
```

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:SC:AOFFset` on page 446

**Subframe Allocation Mode ← Subframe Config (SIB Type 2)**
Defines whether MBSFN periodic scheduling is 1 or 4 frames.

The figure in example "MBSFN Resource Allocation" on page 118 shows a MBSFN allocation composed of 4 frames. The following figure displays a MBSFN allocation with "Subframe allocation mode" set to 1 frame.




Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:SC:AMODe` on page 445

**Allocation value (HEX) ← Subframe Config (SIB Type 2)**
Defines which MBSFN subframes are allocated.

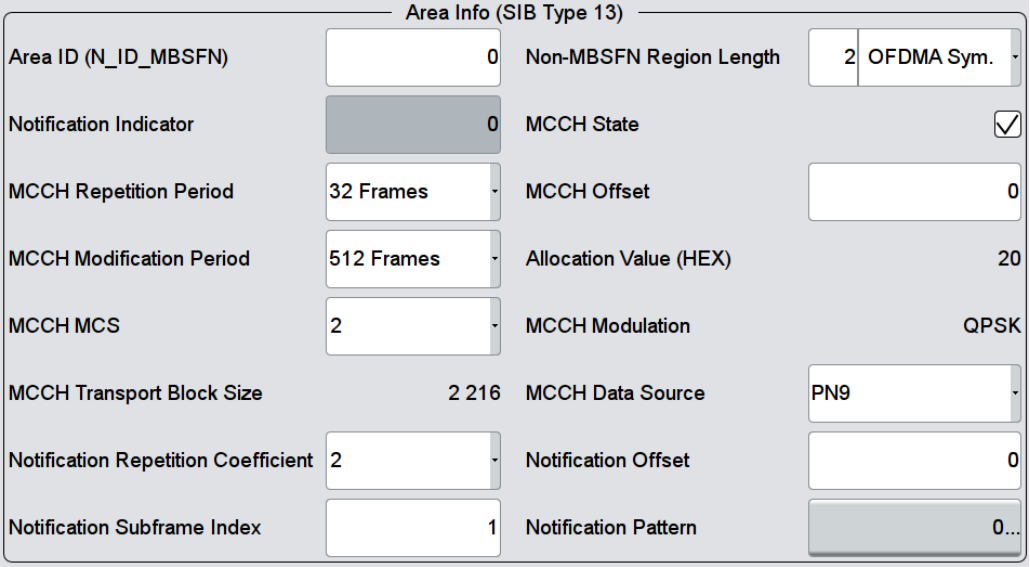
This parameter is identical to the bitmap defined by the field *subframeAllocation* of the MBMS information element *MBSFN-SubframeConfig*.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:SC:AVAL` on page 446

**Area Info (SIB Type 13)**
This section comprises settings for configuration of the general MBSFN area info, i.e. it defines where to find the MCCH. In the “real” system, these values are transmitted via the System Information Block (SIB) Type 13.

The parameters in this section correspond to the MBMS information elements *MBSFN-AreaInfoList* and *MBSFN-NotificationConfig*, as defined in [16].

**Note:** The here described parameters are for configuration of the MBSFN structure only, the coding of the SIB#2 and the SIB#13 is not done automatically.
Also the content of the MCCH is not generated automatically, but has to be set manually by means of an according data source.




**MBSFN-AreaInfoList Parameters ← Area Info (SIB Type 13)**
This section comprises the parameters of the MBMS information element *MBSFN-AreaInfoList*.

**Area ID (N_ID_MBSFN) ← MBSFN-AreaInfoList Parameters ← Area Info (SIB Type 13)**
Defines the MBSFN area ID, parameter $N_{id}^{MBSFN}$.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:ID` on page 438

**Non-MBSFN Region Length ← MBSFN-AreaInfoList Parameters ← Area Info (SIB Type 13)**
Defines how many symbols from the beginning of the subframe constitute the non-MBSFN region.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:NMRL` on page 442

**Notification Indicator ← MBSFN-AreaInfoList Parameters ← Area Info (SIB Type 13)**
Defines which PDCCH bit is used to notify the UE about change of the MCCH applicable for this MBSFN area. Value 0 corresponds to the least significant bit as defined for the DCI Format 1C.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:NIND` on page 442

**MCCH State ← MBSFN-AreaInfoList Parameters ← Area Info (SIB Type 13)**
Enables/disables the MCCH.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:STATe` on page 442

**MCCH Repetition Period ← MBSFN-AreaInfoList Parameters ← Area Info (SIB Type 13)**
Defines the interval between transmissions of MCCH information in radio frames.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:RPER` on page 441

**MCCH Offset ← MBSFN-AreaInfoList Parameters ← Area Info (SIB Type 13)**
Indicates, together with the "MCCH repetition period", the radio frames in which MCCH is scheduled. MCCH is scheduled in radio frames for which:

*SFN mod "MCCH repetition period" = "MCCH offset"*

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:OFFS` on page 441

**MCCH Modification Period ← MBSFN-AreaInfoList Parameters ← Area Info (SIB Type 13)**
Defines periodically appearing boundaries, i.e. radio frames for which the following equation is fulfilled:

*SFN mod "MCCH modification period" = 0*

The contents of different transmissions of MCCH information can only be different if there is at least one such boundary in-between them.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:MPER` on page 440

**Allocation Value (HEX) ← MBSFN-AreaInfoList Parameters ← Area Info (SIB Type 13)**
Indicates the subframes of the radio frames indicated by the "MCCH repetition period" and the "MCCH offset", that may carry MCCH.

**Note:** In the current implementation, the MCCH is always mapped to the first active MBSFN subframe.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:AVAL?` on page 438

**MCCH MCS ← MBSFN-AreaInfoList Parameters ← Area Info (SIB Type 13)**
Defines the Modulation and Coding Scheme (MCS) applicable for the subframes indicated by the "MCCH Allocation value" and for the first subframe of each MCH scheduling period (which may contain the MCH scheduling information provided by MAC).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:MCS` on page 439

**MCCS Modulation ← MBSFN-AreaInfoList Parameters ← Area Info (SIB Type 13)**
Displays the values as determined by the "MCCH MCS".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:MODulation?` on page 439

**MCCH Transport Block Size ← MBSFN-AreaInfoList Parameters ← Area Info (SIB Type 13)**
Displays the values as determined by the "MCCH MCS".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:TBSize?` on page 442

**MCCH Data Source ← MBSFN-AreaInfoList Parameters ← Area Info (SIB Type 13)**
Sets the data source used for the MCCH.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:DATA` on page 439
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:DLISt` on page 439
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:PATTern` on page 441

**MBSFN-NotificationConfig Parameters ← Area Info (SIB Type 13)**
This section comprises the parameters of the MBMS information element *MBSFN-NotificationConfig*.

**Notification Repetition Coefficient ← MBSFN-NotificationConfig Parameters ← Area Info (SIB Type 13)**
Selects the current change notification repetition period common for all MCCHs that are configured. The notification repetition period is calculated as follow:

*change notification repetition period = shortest modification period/ "Notification repetition coefficient"*

Where the *shortest modification period* corresponds with the value of the selected "MCCH modification period".

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:NRC on page 440

**Notification Offset ← MBSFN-NotificationConfig Parameters ← Area Info (SIB Type 13)**
Defines, together with the "Notification Repetition Coefficient", the radio frames in which the MCCH information change notification is scheduled, i.e. the MCCH information change notification is scheduled in radio frames for which:

*SFN mod notification repetition period = "Notification offset"*

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:NOFFset on page 440

**Notification Subframe Index ← MBSFN-NotificationConfig Parameters ← Area Info (SIB Type 13)**
Defines the subframe used to transmit MCCH change notifications on PDCCH.

In FDD: Value 1, 2, 3, 4, 5 and 6 correspond with subframe #1, #2, #3, #6, #7 and #8 respectively

In TDD: Value 1, 2, 3, 4 and 5 correspond with subframe #3, #4, #7, #8 and #9respectively

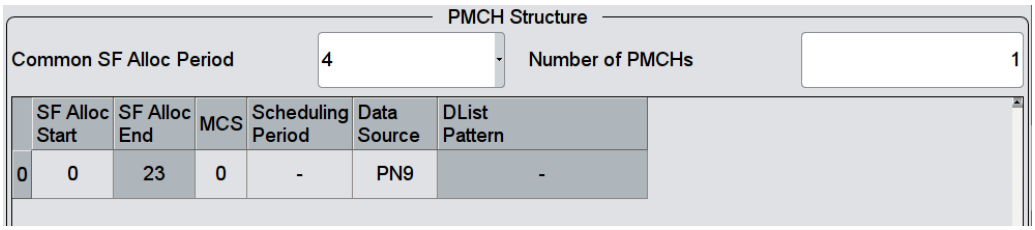
Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:NSI on page 441

**Notification Pattern ← MBSFN-NotificationConfig Parameters ← Area Info (SIB Type 13)**
Sets the pattern for the notification bits sent on PDCCH DCI format 1c.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:NPATtern on page 440

**PMCH Structure**
This section comprises settings for configuration of the PMCH structure, i.e. where to find a PMCH carrying a certain MTCH. In the “real” system, these values are transmitted via the MCCH (*MBSFNAreaConfiguration*).

The parameters in this section correspond to the MBMS information elements *MBSFNAreaConfiguration* and *PMCH-InfoList*, as defined in [16].




**Common Subframe Allocation Period ← PMCH Structure**
Defines the period during which resources corresponding with field *commonSF-Alloc* are divided between the (P)MCH that are configured for this MBSFN area.

The subframe allocation patterns, as defined by *commonSF-Alloc*, repeat continuously during this period.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:MTCH:CSAP on page 443

**PMCH-InfoList Parameters ← PMCH Structure**
Comprises the parameters of the *PMCH-InfoList*.

**Number of PMCHs ← PMCH-InfoList Parameters ← PMCH Structure**
Defines the number of PMCHs in this MBSFN area.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:MTCH:NPMChs on page 443

**SF Alloc Start/SF Alloc End ← PMCH-InfoList Parameters ← PMCH Structure**
Defines the first/last subframe allocated to this (P)MCH within a period identified by field *commonSF-Alloc*.

The subframes allocated to (P)MCH corresponding with the $n^{th}$ entry in *pmch-InfoList* are the subsequent subframes starting from either the subframe identified by "SF Alloc End" of the $(-1)^{th}$ listed (P)MCH or, for n=1, the first subframe, through the subframe identified by "SF Alloc End" of the $n^{th}$ listed (P)MCH. Value 0 corresponds with the first subframe defined by field *commonSF-Alloc*.

**Note:** Configuring the MCHs ("SF Alloc Start" values) from bottom to top. Although the 3GPP specification defines the "SF Alloc End" parameter as the only one required, in this implementation it is mandatory to define the "SF Alloc Start" instead.
The implemented algorithm uses the selected "SF Alloc Start" and calculates automatically the "SF Alloc End" of the corresponding MCH. The algorithm applies the internal rule, that there will be no gap between two consequent MCHs.

It is therefore recommended to configure the MCHs, i.e. define the "SF Alloc Start" values, from bottom to the top. This workaround prevents the configuration of overlapping MCHs.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:SASTart on page 445
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:SAENd on page 445

**MCS ← PMCH-InfoList Parameters ← PMCH Structure**
Defines the value for parameter according to [5] Table 7.1.7.1-1, which defines the Modulation and Coding Scheme (MCS) applicable for the subframes of this (P)MCH as indicated by the field *commonSF-Alloc*. The MCS does however neither apply to the subframes that may carry MCCH, i.e. the subframes indicated by the field *sf-AllocInfo* within System Information Block Type 13, nor for the first subframe of each MCH scheduling period (which may contain the MCH scheduling information provided by MAC).

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:MCS on page 444

**MCH Scheduling Period ← PMCH-InfoList Parameters ← PMCH Structure**
Defines the MCH scheduling period, i.e. the periodicity used for providing MCH scheduling information at lower layers (MAC) applicable for an MCH.

**Note:** The first subframe of the scheduling period may contain the MAC control element and therefore uses MCS of MCCH (however, the data source from PMCH is still used).

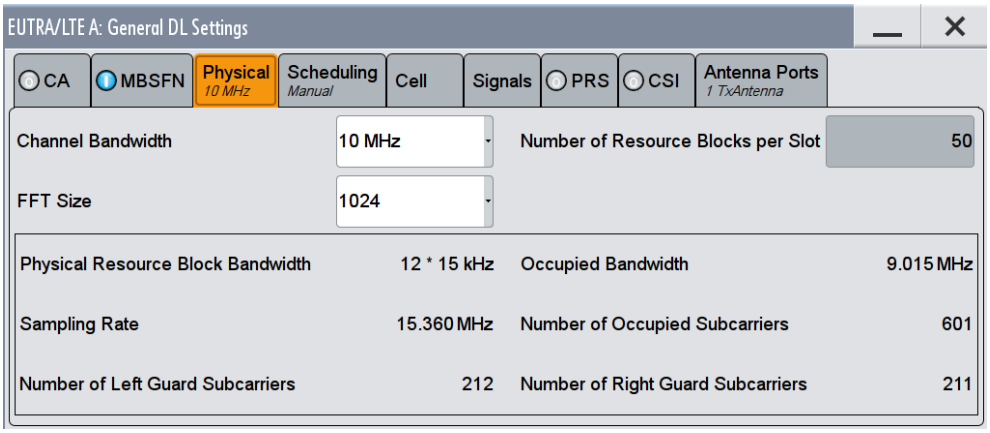
Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:SPERiod` on page 445

**Data Source ← PMCH-InfoList Parameters ← PMCH Structure**
Sets the data source for this PMCH/MTCH.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:DATA` on page 444
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:DLISt` on page 444
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:PATTern` on page 444

## 7.10.3 Physical Settings

1. To access this dialog select "General > Link Direction > Downlink (OFDMA)".
2. Select "General DL Settings > Physical".




In this dialog, the channel bandwidth respectively the number of resource blocks per slot is selected. The other parameters are fixed and read-only.

**Channel Bandwidth**
Sets the channel bandwidth of the EUTRA/LTE system.

Although the 3GPP specification bases on bandwidth agonistic layer 1 and channel bandwidth is determined by specifying the desired number of resource blocks, the current EUTRA standardization focuses on six bandwidths (1.4, 3, 5, 10, 15 and 20 MHz).

For backward compatibility with previous version of this software, this parameter allows the flexibility to choose, whether a user defined bandwidth or one of the pre-defined channel bandwidths is used.

If a pre-defined channel bandwidth is selected; the actual "Number of Resource Blocks Per Slot" is internally calculated for the selected "Channel Bandwidth" and "Physical Resource Block Bandwidth".

The sampling rate, occupied bandwidth and FFT size are therefore determined by the parameter "Number of Resource Blocks Per Slot". If required, the FFT Size can be adjusted.

See also table 4-1 for an overview of this cross-reference between the parameters.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:BW on page 404

**Physical Resource Block Bandwidth**
Displays the bandwidth of one physical resource block.

**Note:** In this release, this value is fixed to 12 x 15 kHz.

Remote command:
n.a.

**Number of Resource Blocks Per Slot**
This parameter determines the channel bandwidth.

If the parameter "Channel Bandwidth" is set to one of the pre-defined channel bandwidths (1.4, 3, 5, 10, 15 or 20 MHz), the value "Number of Resource Blocks Per Slot" is read only and is automatically set according to the selected channel bandwidth and "Physical Resource Block Bandwidth".

If a user defined channel bandwidth is selected, the parameters "Number of Resource Blocks Per Slot" and "Physical Resource Blocks Bandwidth" determine the actual channel bandwidth.

However, the sampling rate and the occupied bandwidth are determined by the parameter "Number of Resource Blocks Per Slot". If required, the FFT Size can be adjusted.

See also table 4-1 for an overview of this cross-reference between the parameters.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:NORB on page 404

**FFT Size**
Sets the FFT (Fast Fourier Transformation) size.

The FFT size can be freely selected for all bandwidth definitions under the following constrains:

- For a specific bandwidth, all FFT sizes are applicable as long as the size is greater than the number of occupied subcarriers.
  By default, the smallest available FFT size is selected.
- To decrease the number of unused guard subcarriers and the resulting sampling rate, for channel bandwidth of 15 MHz a DFT size of 1536 is provided along with the default FFT size of 2048.

See also table 4-1 for an overview of the cross-reference between the parameter and the available FFT sizes.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:FFT on page 405

**Occupied Bandwidth**
Displays the occupied bandwidth. The value is automatically set according to the parameter "Number of Resource Blocks Per Slot".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:OCCBandwidth?` on page 405

**Sampling Rate**
Displays the sampling rate. The value is automatically set according to the parameter "Number of Resource Blocks Per Slot."

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:SRATe?` on page 405

**Number Of Occupied Subcarriers**
Displays the number of occupied subcarriers. The value is automatically set according to the parameter "Number of Resource Blocks Per Slot".

See also table 4-1 for an overview of this cross-reference between the parameters.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:OCCSubcarriers?` on page 406

**Number Of Left Guard Subcarriers**
Displays the number of left guard subcarriers. This value is set automatically according to the parameter "Number of Resource Blocks Per Slot".

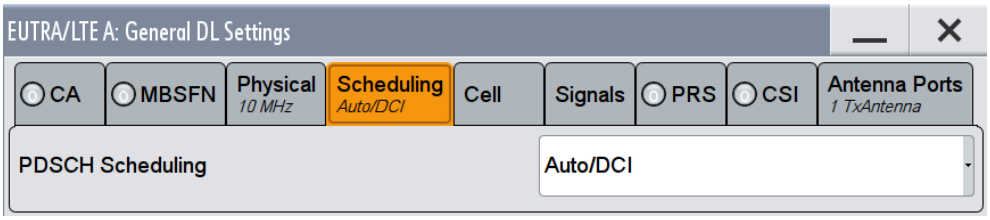
Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:LGS?` on page 406

**Number Of Right Guard Subcarriers**
Displays the number of right guard subcarriers. This value is set automatically according to the parameter "Number of Resource Blocks Per Slot".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:RGS?` on page 406

## 7.10.4 Scheduling Settings

1. To access this dialog select "General > Link Direction > Downlink (OFDMA)".
2. Select "General DL Settings > Scheduling".




In the "Scheduling" section, you define whether the PDSCH Scheduling is performed manually or according to the configuration made for the DCIs.

**PDSCH Scheduling**
Determines whether the configuration and scheduling of the different PDSCH allocations inside of the DL allocation table is performed manually or according to the configuration made for the DCIs.

**Note:** Switching from "Auto/DCI" mode to "Manual" mode enables all parameters in the DL allocation table for configuration without to change their values. Switching from "Manual" to "Auto/DCI" mode, however, triggers a reset of the frame prior to reconfiguration of the PDSCH allocations according to the settings made for the PDCCH DCIs, i.e. the settings made in the DL allocation table are lost.

"Manual" In this default mode, there is no cross-reference between the settings made for the PDCCH DCIs and the PDSCHs settings. The PDSCH allocations have to be configured manually in the DL allocation table.

"Auto/DCI" Precoding for spatial multiplexing will be performed according to 3GPP TS 36.211 and the selected parameters.
This mode assures a 3GPP compliant EUTRA/LTE signal and the PDSCH allocations are configured automatically according to the configuration of the PDCCH DCIs.

The generation of a compliant signal requires some limitations in the configuration flexibility, especially regarding the power setting:

- The value of the parameter Reference Signal Power is fixed to 0dB.
- The PDSCH Rho A of each allocation belonging to a user is set as configured with the parameter P_A for the corresponding user in the "Configure User" dialog.
- All four users are activated with enabled Scrambling and Channel Coding.

Not all combinations of DCI Table, Users and UE_ID/n_RNTI are allowed. The table 7-7 shows this dependency.

***Table 7-7: DCI Formats dependencies***

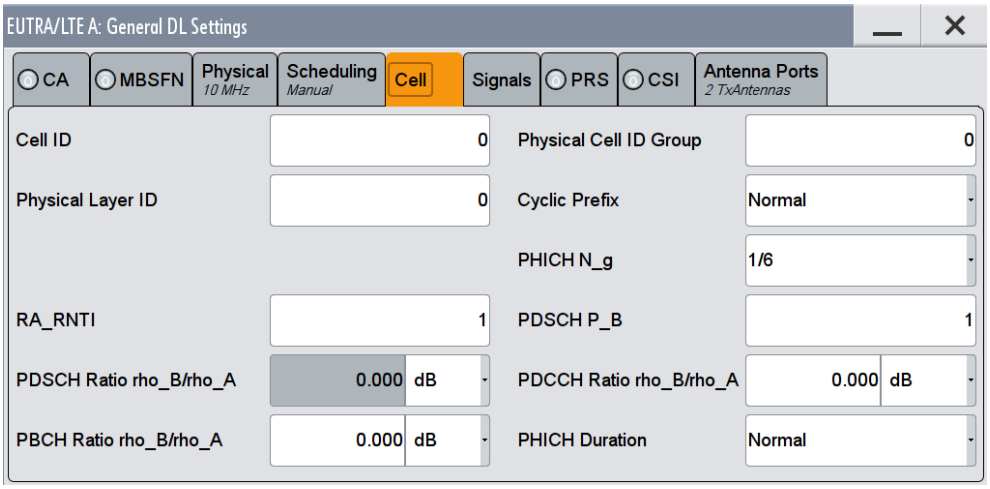
| User | UE ID/n_RNTI | DCI Format |
|---|---|---|
| User 1 .. 4 | As defined for the corresponding user | 0,1,1a,1b,1d,2,2a,3,3a |
| P-RNTI | 65534 | 1a,1c |
| SI-RNTI | 65535 | |
| RA-RNTI | As defined with the parameter RA_RNTI in the "General DL Setting" dialog | |

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CONF:MODE` on page 400

## 7.10.5 Cell Specific Settings

1. To access this dialog select "General > Link Direction > Downlink (OFDMA)".

2. Select "General DL Settings > Cell".




The "Cell Specific Settings" section comprises the physical layer cell identity settings and the DL power control settings.
The TDD settings are available only, if the TDD is selected as a duplexing mode. The TDD frame is configured by means of adjustment of the UL/DL configuration and the special subframe configuration.

**Cell ID**
Sets the cell identity.

There are 504 unique physical layer cell identities (Cell ID), grouped into 168 unique physical cell identity groups that contain three unique identities each. The Cell ID is calculated as following:

Cell ID = 3*Physical Cell ID Group + Physical Layer ID

There is a cross-reference between the values of this three parameters and changing of one of them results in adjustment in the values of the others.

The Cell ID determinates:
- the downlink reference signal pseudo-random sequence,
- the frequency shifts of the reference signal,
- the S-SYNC sequence,
- the cyclic shifts for PCFICH, PHICH and PDCCH mapping and
- the pseudo-random sequence used for scrambling.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:PLCi]:CID` on page 407

**Physical Cell ID Group**
Sets the physical cell identity group.

To configure these identities within a cell ID group, set the parameter Physical Layer ID.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:PLCi]:CIDGroup` on page 407

**Physical Layer ID**
Sets the identity of the physical layer within the selected physical cell identity group, set with parameterPhysical Cell ID Group .

The Physical Layer ID determinates the Zadoff-Chu orthogonal sequence carried by the P-SYNC and used for cell search.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:PLCi]:PLID` on page 408

**Cyclic Prefix (General DL Settings)**
Sets the cyclic prefix length for all subframes.

The number of the OFDM symbols is set automatically.

"Normal" Normal cyclic prefix, i.e. the DL slot contains 7 OFDM symbols.

"Extended" Extended cyclic prefix, i.e. the DL slot contains 6 OFDM symbols. The extended cyclic prefix is defined in order to cover large cell scenarios with higher delay spread and MBMS transmission.

"User Defined" The cyclic prefix length can vary over the subframes. The cyclic prefix length is set per subframe in the DL Frame Configuration menu with the parameter Cyclic Prefix.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CPC` on page 408

**UL/DL Cyclic Prefix**
In "Duplexing > TDD", determines the cyclic prefix for the appropriate opposite direction.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:DLCPc` on page 418
`[:SOURce<hw>]:BB:EUTRa:DL:ULCPc` on page 409

**PDSCH P_B**
Sets the parameter PDSCH P_B and defines the cell-specific ratio rho_B/rho_A according to 3GPP TS 36.213, Table 5.2-1.

The following table gives an overview of the resulting values of the parameter PBCH Ratio rho_B/rho_A as function of the values for the parameter PDSCH P_B and the number of configured antennas.

| PDSCH P_B | 1 Tx antenna | 2 or 4 Tx antennas |
|---|---|---|
| 0 | 0.000 dB | 0.969 dB |
| 1 | -0.969 dB | 0.000 dB |
| 2 | -2.218 dB | -1.249 dB |
| 3 | -3.979 dB | - 3.010 dB |

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:PDSCh:PB` on page 410

**PDSCH Ratio rho_B/rho_A**
Displays the transmit energy ratio among the resource elements allocated for PDSCH in the OFDM symbols containing reference signal (P_B) and such not containing one (P_A).

The value displayed is determined by the parameter PDSCH P_B and additionally depends on the number of configured antennas.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:PDSCh:RATBa` on page 410

**PDCCH Ratio rho_B/rho_A**
Sets the transmit energy ratio among the resource elements allocated for PDCCH in the OFDM symbols containing reference signal (P_B) and such not containing one (P_A).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:PDCCh:RATBa` on page 409

**PBCH Ratio rho_B/rho_A**
Sets the transmit energy ratio among the resource elements allocated for PBCH in the OFDM symbols containing reference signal (P_B) and such not containing one (P_A).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:PBCH:RATBa` on page 409

**PHICH Duration**
Sets the PHICH duration, i.e. the allocation of the PHICH resource element groups over the OFDM symbols.

The value selected puts the lower limit of the size of the PCFICH Settings that is signaled by the PCFICH.

"Normal" All resources element groups of PHICH (see Number of PHICH Groups) are allocated on the first OFDM symbol (OFDM Symbol 0).

"Extended" The resources element groups of PHICH are distributed over three OFDM symbols for a normal subframe or over two symbols within a special one.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:PHICh:DURation` on page 410

**PHICH N_g**
Sets the parameter N_g according to 3GPP TS 36.211, section 6.9.

"1/6, ½, 1, 2" The actual Number of PHICH Groups for the different subframes is calculated according to the following formula:

$$N_{PHICH}^{group} = \begin{cases} \lceil N_g (N_{RB}^{DL}/8) \rceil & \text{for normal cyclic prefix} \\ \lceil 2 \cdot N_g (N_{RB}^{DL}/8) \rceil & \text{for extended cyclic prefix} \end{cases}$$

In FDD mode, the calculated value corresponds directly to the parameter "Number of PHICH Groups".
In TDD mode however, the resulting value for the parameter Number of PHICH Groups is the value calculated according to the formula above, additionally multiplied with a coefficient selected from the following table.

| UL/DL Configuration | Subframe number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 0 | 2 | 1 | - | - | - | 2 | 1 | - | - | - |
| 1 | 0 | 1 | - | - | 1 | 0 | 1 | - | - | 1 |
| 2 | 0 | 0 | - | 1 | 0 | 0 | 0 | - | 1 | 0 |
| 3 | 1 | 0 | - | - | - | 0 | 0 | 0 | 1 | 1 |
| 4 | 0 | 0 | - | - | 0 | 0 | 0 | 0 | 1 | 1 |
| 5 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 6 | 1 | 1 | - | - | - | 1 | 1 | - | - | 1 |

The parameter "Number of PHICH Groups" is read-only.

"Custom" Enables the selection of user-defined value for the parameter "Number of PHICH Groups".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:PHICh:NGParameter` on page 411

**RA_RNTI**
Sets the random-access response identity RA-RNTI.

The value selected here determined the value of the parameter UE_ID/n_RNTI in case a RA_RNTI "User" is selected.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CSETtings:RARNti` on page 408

## 7.10.6 TDD Frame Structure Settings

The "TDD Frame Structure" section is available only, if the TDD is selected as a duplexing mode. In this section, the TDD frame is configured by means of adjustment of the UL/DL configuration and the special subframe configuration (see also chapter 3.2.1, "OFDMA Parameterization", on page 18).

**UL/DL Configuration**
Sets the Uplink-Downlink Configuration number, i.e. defines which subframe is used for downlink respectively uplink, and where the special subframes are located.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TDD:UDConf` on page 399

**Configuration of Special Subframes**
Sets the Special Subframe Configuration number, i.e. together with the parameter Cyclic Prefix defines the lengths of the DwPTS, the Guard Period and the UpPTS.

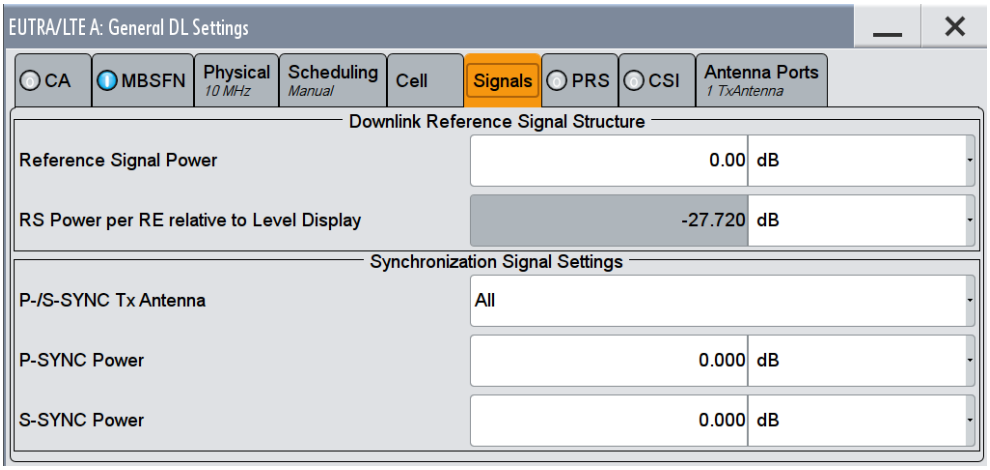
The DwPTS length selected with this parameter determines the maximum number of the OFDM symbols available for PDSCH in the special subframe.

The UpPTS length selected with this parameter determines the maximum number of the SC-FDMA symbols available for SRS in the special subframe.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TDD:SPSConf` on page 399

## 7.10.7 Downlink Signals Settings

1. To access this dialog select "General > Link Direction > Downlink (OFDMA)".
2. Select "General DL Settings > Signals".




The "Signals" dialog comprises the "Downlink Reference Signal Structure" and the "Synchronization Signal Settings" sections. Use this settings to set the power level of the reference signals and the P-/S-SYNC and to enable/disable the P-/S-SYNC.

### 7.10.7.1 Downlink Reference Signal Structure

In the "Downlink Reference Signal Structure" section, the power of the reference signals is set.

For an overview of the provided power settings and detailed information on how to adjust them, refer to chapter 5.3, "Power Setting", on page 59.

**Reference Signal Power**
Sets the power of the reference signal (PRS relative).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:REFSig:POWer` on page 403

**RS Power per RE relative to Level Display**
Displays the power of the reference signal (RS) per resource element (RE) relative to the power value, displayed in the Level display in the header of the instrument.

**Note:** The displayed value is actualized only if the EUTRA/LTE signal generation is enabled (State = On).

If a MIMO configuration is enabled, the value of this parameter is equal for all antennas; this applies also for the antenna configured in the path B.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:REFSig:EPRE` on page 403

#### 7.10.7.2 Synchronization Signal Settings

In the "Synchronization Signal Settings" section, the power of the P-SYNC/S-SYNC is set.

**P-/S-SYNC Tx Antenna**
Defines on which antenna port the P-/S-SYNC is transmitted.

The available values depend on the number of configured antennas.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:SYNC:TXANtenna` on page 403

**P-SYNC Power**
Sets the power of the P-SYNC allocations.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:SYNC:PPOWer` on page 404

**S-SYNC Power**
Sets the power of the S-SYNC allocations.

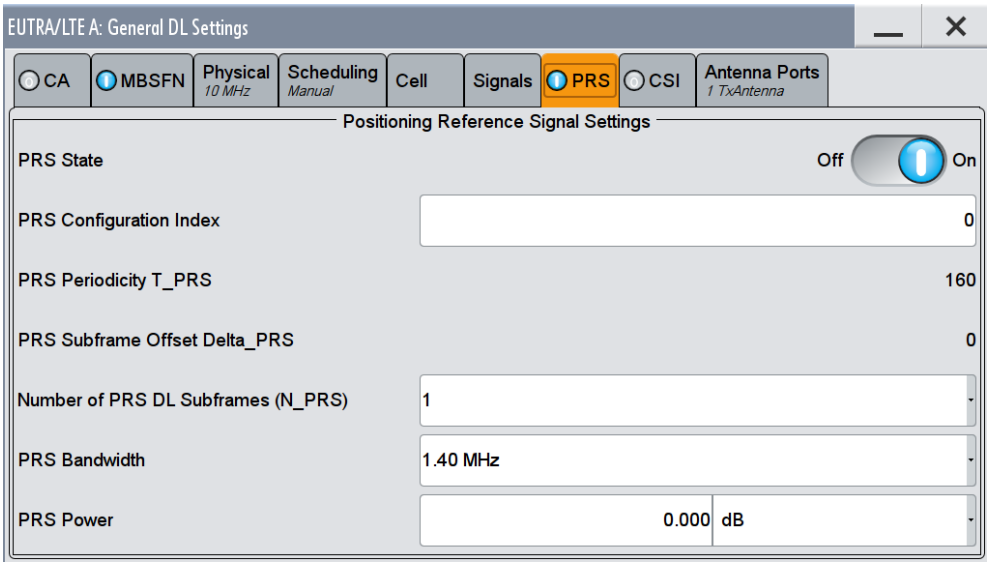
Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:SYNC:SPOWer` on page 404

### 7.10.8 Positioning Reference Signal (PRS) Settings

Configuration of the PRSs requires additional SW option R&S SMW-K84.

1. To access this dialog select "General > Link Direction > Downlink (OFDMA)".

2. Select "General DL Settings > PRS".




This section comprises the setting necessary to configure the positioning reference signals (PRS). See also chapter 3.2.5.4, "Positioning reference signals", on page 27.

If PRS and MBSFN is configured to be in the same subframe, MBSFN is skipped and PRS is transmitted solely.

If a PDSCH is configured to overlap partially with the PRS bandwidth in a PRS subframe, the PRS in these resource blocks are skipped then.

**Example: Overlapping PDSCH, PRS and MBSFN**

PRS State = ON

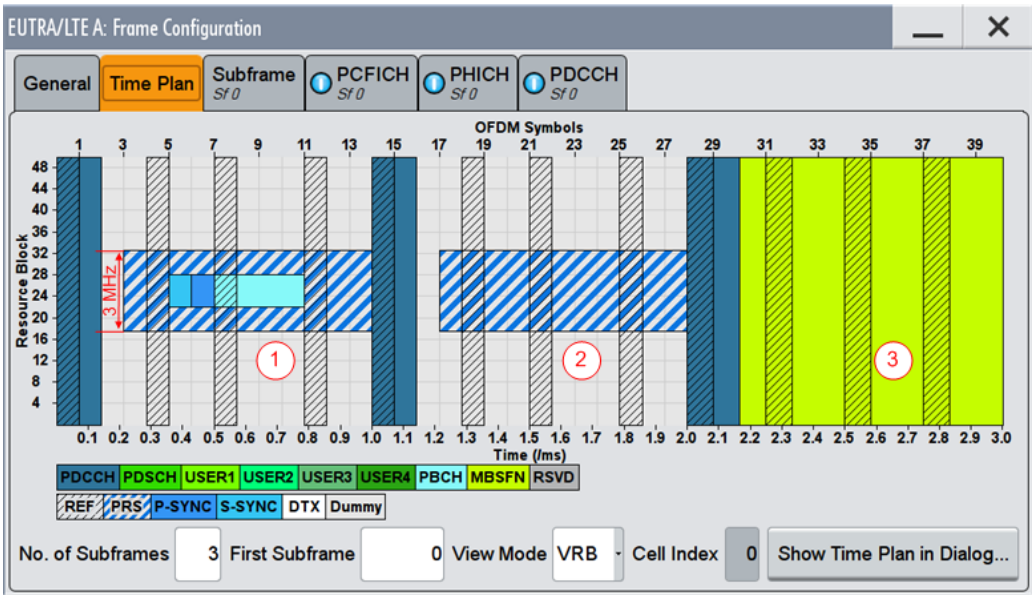
PRS Configuration Index = 0

Number of PRS DL Subframes (N_PRS) = 2

PRS Bandwidth = 3 MHz

MBSFN Mode = Mixed

Use the OFDMA Timeplan to show the allocation of the PRSs.




1 = PDSCH and PRS are overlapping in the subframe#0
2 = MBSFN is ignored in subframe#1
1+2 = two consequent PRS subframes with 3 MHz Bandwidth
3 = first MBSFN subframe

**PRS State**
Enables the generation of the PRS.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:PRSS:STATe` on page 413

**PRS Configuration Index**
Sets the PRS Configuration Index $I_{PRS}$ as defined in 3GPP TS 36.211, table 6.10.4.3-1.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:PRSS:CI` on page 412

**PRS Periodicity T_PRS**
Displays the periodicity of the PRS generation ($T_{PRS}$) as defined in 3GPP TS 36.211, table 6.10.4.3-1.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:PRSS:TPRS?` on page 413

**PRS Subframe offset Delta_PRS**
Displays the subframe offset of the PRS generation ($Delta_{PRS}$) as defined in 3GPP TS 36.211, table 6.10.4.3-1.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:PRSS:DPRS?` on page 412

**Number of PRS DL Subframes (N_PRS)**
Defines the number of consecutive DL subframes in that PRS are transmitted.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:PRSS:NPRS` on page 412

**PRS Bandwidth**
Defines the RBs in which the PRS is transmitted.

**Note:** The PRS Bandwidth must not be bigger than channel bandwidth.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:PRSS:BW` on page 411

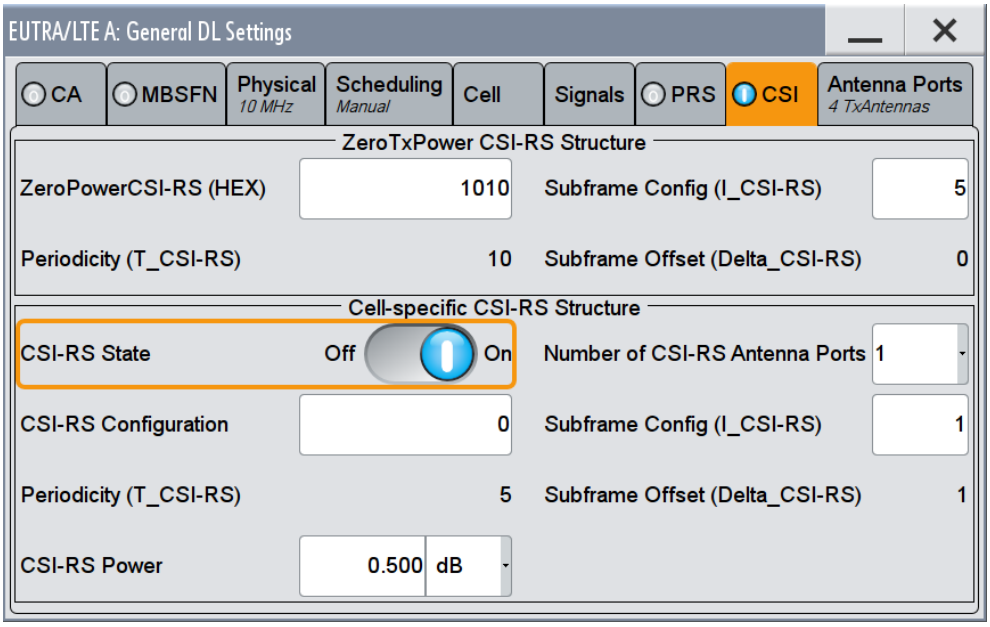
**PRS Power**
Sets the power of a PRS resource element relative to the power of a common reference signal resource element.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:PRSS:POW` on page 412

### 7.10.9 CSI Settings

To access this dialog:

1. Select "General > Link Direction > Downlink (OFDMA)".
2. Select "General DL Settings > CSI".




This dialog comprises the settings for configuring the channel-state information reference signal (CSI-RS) structure. For detailed information, see

The 3GPP TS 36.211 [3] specifies the occurance of the CSI reference signal in the subframes as function of the subframe configuration period $T_{CSI-RS}$ and the subframe offset $\Delta_{CSI-RS}$. The available value ranges are listed in table 7-8. The parameter $I_{CSI-RS}$ is can be configured separatelly for the zero () and non-zero transmission power ("Cell-specific CSI-RS Structure" on page 143) cases.

***Table 7-8: CSI reference signal structure configuration [3]***

| CSI-RS subframe configuration $I_{CSI-RS}$ | CSI-RS periodicity $T_{CSI-RS}$ (subframes) | CSI-RS subframe offset $\Delta_{CSI-RS}$ (subframes) |
|---|---|---|
| 0 - 4 | 5 | $I_{CSI-RS}$ |
| 5 - 14 | 10 | $I_{CSI-RS}$ - 5 |
| 15 - 34 | 20 | $I_{CSI-RS}$ - 15 |
| 35 - 74 | 40 | $I_{CSI-RS}$ - 35 |
| 75 - 154 | 80 | $I_{CSI-RS}$ - 75 |

### How to enable a CSI-RS transmission

1. Select "EUTRA/LTE > Link Direction > Downlink (OFDMA)".
2. Select "EUTRA/LTE > State > On".
3. Select "EUTRA/LTE > General Downlink Settings".
4. In the "General Downlink Settings", select "CSI" and configure the settings as required.
   For example, enable the settings displayed in the figure above.

5. Enable "Cell-specific CSI-RS Structure > Subframe Config (I_CSI-RS) = 1".
6. Select "Cell-specific CSI-RS Structure > CSI-RS State > On" and close the dialog.
7. Select "EUTRA/LTE > Frame Configuration".
8. Select "Frame Configuration > Subframe > Subframe Selection = 1" to configure the subframe selected for the CSI-RS transmission.
9. Set "No. of Used Allocations = 2".

   The allocation table displays the activated PDSCH allocation with the corresponding number of used "Phys. Bits".
10. In the allocation table, for this PDSCH allocation select "Ench. Settings > Config".
11. In the ENHANCED SETTINGS dialog, select "CSI-RS > Awareness > On".
12. In the allocation table, select the PDSCH allocation and compare the number o fused "Phys. Bits".

    The displayed information confirms, that less physical bits are allocated for the PDSCH, because some resources are reserved for the CSI-RS transmission.

    Use the parameter CSI Awareness to inform an UE that a CSI-RS transmission is used.

**ZeroTxPower CSI-RS Structure**
Comprises the following zero transmission power parameters:

**ZeroPowerCSI-RS (HEX) ← ZeroTxPower CSI-RS Structure**
Sets the used CSI-RS configurations in the zero transmission power subframes. Required is a 16-bit-long hexidecimal value (bitmap). The UE assumes a zero transmission power for each bit set to one.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CSIS:ZP` on page 452

**Subframe Config (I_CSI-RS) ← ZeroTxPower CSI-RS Structure**
Sets the parameter $I_{CSI-RS}$ for CSI-RS with zero transmission power, see table 7-8.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CSIS:ZPI` on page 453

**Periodicity (T_CSI-RS) ← ZeroTxPower CSI-RS Structure**
Sets the parameter subframe configuration period $T_{CSI-RS}$ for CSI-RS with zero transmission power, see table 7-8.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CSIS:ZPT?` on page 453

**Subframe Offset (Delta_CSI-RS) ← ZeroTxPower CSI-RS Structure**
Sets the parameter subframe offset $\Delta_{CSI-RS}$ for CSI-RS with zero transmission power, see table 7-8.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CSIS:ZPDelta?` on page 452

**Cell-specific CSI-RS Structure**
Comprises the following cell-specific parameters:

**CSI-RS State ← Cell-specific CSI-RS Structure**
Enables the transmission of a CSI-RS, see also "How to enable a CSI-RS transmission" on page 141.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CSIS:STATe` on page 452

**Number of CSI-RS Antenna Ports ← Cell-specific CSI-RS Structure**
Defines the number of antenna ports (one, two, four or eight) the CSI-RS are transmitted on.

Use the Cell Specific Antenna Port Mapping and configure the cell-specific antenna port mapping of the antenna ports AP15 - AP22.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CSIS:NAP` on page 451

**CSI-RS Configuration ← Cell-specific CSI-RS Structure**
Defines the CSI-RS configuration used for the current cell and for wich the UE assumes non-zero transmission power. The zero transmission power sunframes are determined by the ZeroPowerCSI-RS (HEX).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CSIS:CONFig` on page 451

**Subframe Config (I_CSI-RS) ← Cell-specific CSI-RS Structure**
Sets the parameter $I_{CSI-RS}$ for cell-specific CSI-RS, see table 7-8.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CSIS:SFI` on page 452

**Periodicity (T_CSI-RS) ← Cell-specific CSI-RS Structure**
Sets the parameter subframe configuration period $T_{CSI-RS}$ for cell-specific CSI-RS, see table 7-8.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CSIS:SFT?` on page 452

**Subframe Offset (Delta_CSI-RS) ← Cell-specific CSI-RS Structure**
Sets the parameter subframe offset $\Delta_{CSI-RS}$ for cell-specific CSI-RS, see table 7-8.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CSIS:SFDelta?` on page 451

**CSI-RS Power ← Cell-specific CSI-RS Structure**
Boosts the CSI-RS power compared to the cell-specific reference signals.

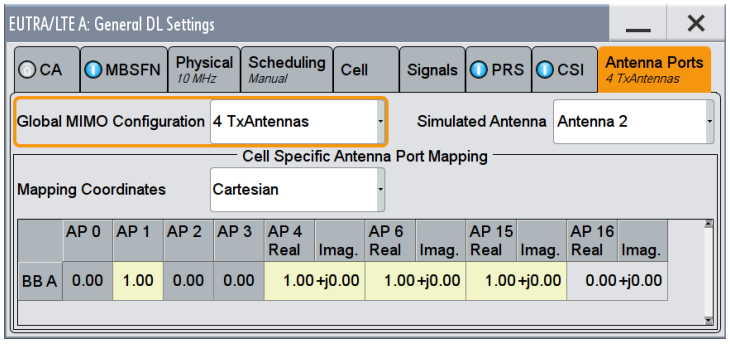
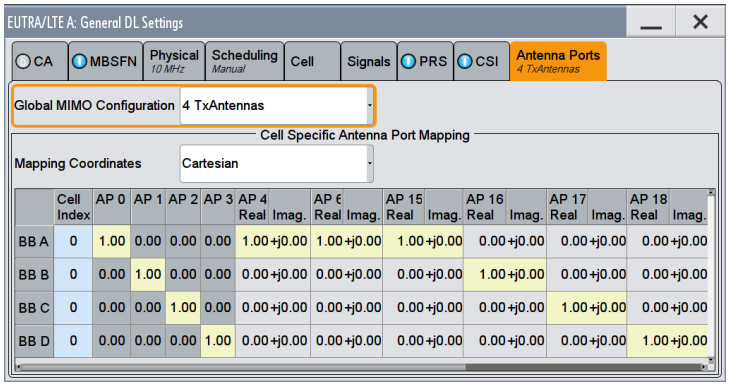
Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CSIS:POW` on page 451

## 7.10.10 Antenna Ports Settings

1. To access this dialog select "General > Link Direction > Downlink (OFDMA)".
2. Select "General DL Settings > Antenna Ports".

   In the "Antenna Ports" section, the MIMO configuration and the simulated antennas are defined.
   The provided settings depends on the selected "System Configuration > Fading and Baseband Configuration > Mode" and the enabled LxMxN MIMO scenario, i.e. the number of enabled "Entities", "Basebands" and "Streams". Refer to the user manual of the base unit.
   See table 7-9 and compare the displayed settings for the same 4x4 MIMO configuration.

***Table 7-9: Antenna ports settings depending on the ebabled MxN MIMO configuration and "System Configuration" mode***

| **"System Configuration > Fading/Baseband Configuration > Mode"** | **"System Configuration > Fading/Baseband Configuration > 1x4x4"** |
|---|---|
| "Standard" |  |
| "Advanced" |  |

EUTRA/LTE A: General DL Settings
CA
MBSFN
Physical 10 MHz
Scheduling Manual
Cell
Signals
PRS
CSI
Antenna Ports 4 TxAntennas
Global MIMO Configuration 4 TxAntennas
Simulated Antenna Antenna 2
Cell Specific Antenna Port Mapping
Mapping Coordinates Cartesian
AP 0 AP 1 AP 2 AP 3 AP 4 Real Imag. AP 6 Real Imag. AP 15 Real Imag. AP 16 Real Imag.
BB A 0.00 1.00 0.00 0.00 1.00+j0.00 1.00+j0.00 1.00+j0.00 0.00+j0.00

EUTRA/LTE A: General DL Settings
CA
MBSFN
Physical 10 MHz
Scheduling Manual
Cell
Signals
PRS
CSI
Antenna Ports 4 TxAntennas
Global MIMO Configuration 4 TxAntennas
Cell Specific Antenna Port Mapping
Mapping Coordinates Cartesian
Cell Index AP 0 AP 1 AP 2 AP 3 AP 4 Real Imag. AP 15 Real Imag. AP 16 Real Imag. AP 17 Real Imag. AP 18 Real Imag.
BB A 0 1.00 0.00 0.00 0.00 1.00+j0.00 1.00+j0.00 0.00+j0.00 0.00+j0.00 0.00+j0.00
BB B 0 0.00 1.00 0.00 0.00 0.00+j0.00 0.00+j0.00 0.00+j0.00 0.00+j0.00 0.00+j0.00
BB C 0 0.00 0.00 1.00 0.00 0.00+j0.00 0.00+j0.00 0.00+j0.00 1.00+j0.00 0.00+j0.00
BB D 0 0.00 0.00 0.00 1.00 0.00+j0.00 0.00+j0.00 0.00+j0.00 0.00+j0.00 1.00+j0.00

**Global MIMO Configuration**
Determines the number of transmit antennas of the simulated EUTRA/LTE system. Depending on this parameter, the Downlink Reference Signal Structure will be set accordingly (see also figure 3-9).

**Note:** One baseband simulates one antenna.

"1 TxAntenna" Enables single antenna port transmission.

"2 TxAntennas/ 4 TxAntennas" Enables a multiple antenna transmission. The transmission mode, transmit diversity or spatial multiplexing, is determined per allocation with the parameter Precoding Scheme.

"SISO + BF" This mode combines a 1 Tx-antenna Single Input Single Output (SISO) transmission with beamforming (BF).
This is the default mode in "System Configuration = 1x8x2", i.e. if the instrument is configured to generate a sharp beamformed signal with 8 Tx and 2 Rx antennas.
Beamforming is a method to increase the SNR of the signal received by the UE. In this mode, beamforming is implemented as a single layer PDSCH which is mapped to the different antennas with individual phase offsets. To simplify the configuration and in order to fulfill the requirements as specified in 3GPP TS 36.101, Annex A the same precoding vector as in a MIMO case can be used.

**Note:** While generating signal in this mode, the antennas simulated by path A and Path B are **not** MIMO antennas. The signal at the output of both paths is the same SISO signal with the same **cell-specific reference signals**.
To enable the instrument to generate a **transmission using antenna port 5** signal (transmission corresponding to the UE-specific reference signal) as defined in the 3GPP specification, set the parameter Precoding Scheme to "Beamforming (UE-spec.RS)".

In this case, the generated signal carries a combination of common signal part (PBCH, PDCCH, cell-specific RS,...), which is identical on all antennas, and UE-specific PDSCH, which is different on the antennas due to the applied precoding.

Note that, although the generation of a beamformed signal requires more than one antenna, for the UE it appears as a SISO signal.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MIMO:CONFiguration` on page 401

**Simulated Antenna**
In "System Configuration > Fading/Baseband Configuration > Mode > Standard", determines the antenna to be simulated in the current baseband.

The configuration of the Downlink Reference Signal structure is set accordingly (see figure 3-9).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MIMO:ANTenna` on page 401

**Cell Specific Antenna Port Mapping**
(enabled for instruments eqquiped with R&S SMW-K84)

Comprises the settings for defining the mapping of the logical antenna ports to the available physical Tx antennas (Basebands).

Refer to chapter 7.13, "Antenna Port Mapping Settings", on page 197 for description of the provided settings.

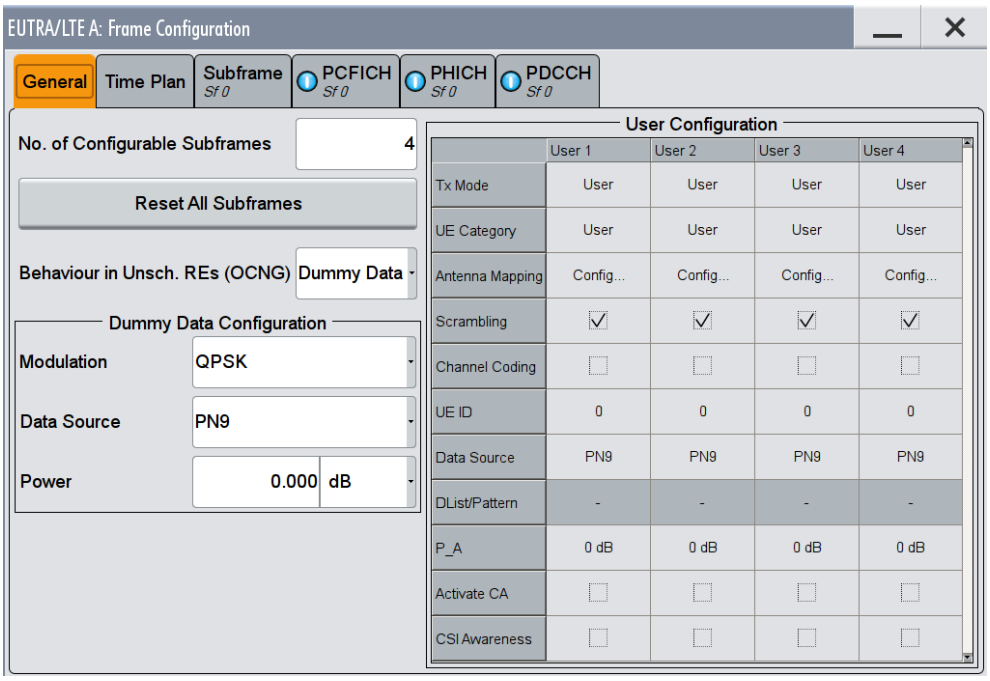
# 7.11 DL Frame Configuration Settings

1. To access this dialog, select "General > Link Direction > Downlink (OFDMA)".
2. Select "Frame Configuration".

   The "DL Frame Configuration" dialog allows you to configure the subframes and the OFDMA resource allocations. The dialog consists of several tabs.

## 7.11.1 General Frame Configuration Settings

1. To access this dialog, select "General > Link Direction > Downlink (OFDMA)".
2. Select "Frame Configuration > General".




This dialog comprises the general settings that can be configured in the OFDMA mode.

Provided are the following settings:

**No Of Configurable (DL) Subframes**
Sets the number of configurable subframes. Only the downlink and the special subframes are enabled for configuration if TDD mode is selected.

All downlink/special subframes are filled periodically with the configured subframes with the exception of the P-SYNC/S-SYNC which are set globally in the "General DL Settings" menu and the PBCH which can only be configured in subframe 0.

For more detailed information about the maximum number of configurable subframes and for description of the dependencies between the parameters, see chapter 5.2.3, "Four Configurable Frames in Uplink and Downlink Direction", on page 55.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CONSubframes` on page 428

**Reset Subframe Configuration**
Resets settings of all subframes including cyclic prefix and number of used allocations to the default values.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:RSTFrame` on page 428

**Behavior In Unscheduled REs (OCNG)**
Selects either to fill unscheduled resource elements and subframes with dummy data or DTX.

This function can be used as an OFDMA Channel Noise Generator (OCNG) according to 3GPP TS 36.101.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:BUR` on page 427

### 7.11.2 Dummy Data Configuration Settings

► To access this dialog, select "Frame Configuration > Behaviour in Unsch. REs > Dummy Data ".

In this section, the dummy data for filling the unscheduled resource blocks and subframes are configured.

**Modulation (Dummy Data)**
Selects the modulation of the dummy data.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:DUMD:MODulation` on page 513

**Data Source (Dummy Data)**
Selects the data source for the dummy data configuration.

"Data lists" can be generated internally in the data editor or externally.

Data lists are selected in the "File Select" window, which is called by means of the "Data List Management" button.

If the "Pattern" data type is used, the bit pattern is defined in the "Pattern" input box. The length is limited to 64 bits.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:DUMD:DATA` on page 513

**Pattern (Dummy Data)**
(Available for data source Pattern only)

Opens the editor for configuring a bit pattern. The length is limited to 64 bits.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:DUMD:PATTern` on page 514

**Select Data List (Dummy Data)**
(Available for data source Data List only)

Opens the "Load Data List" window for loading a saved dummy data list. The data list of the selected (highlighted) file is loaded by pressing the "Select" button.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:DUMD:DSELect` on page 513

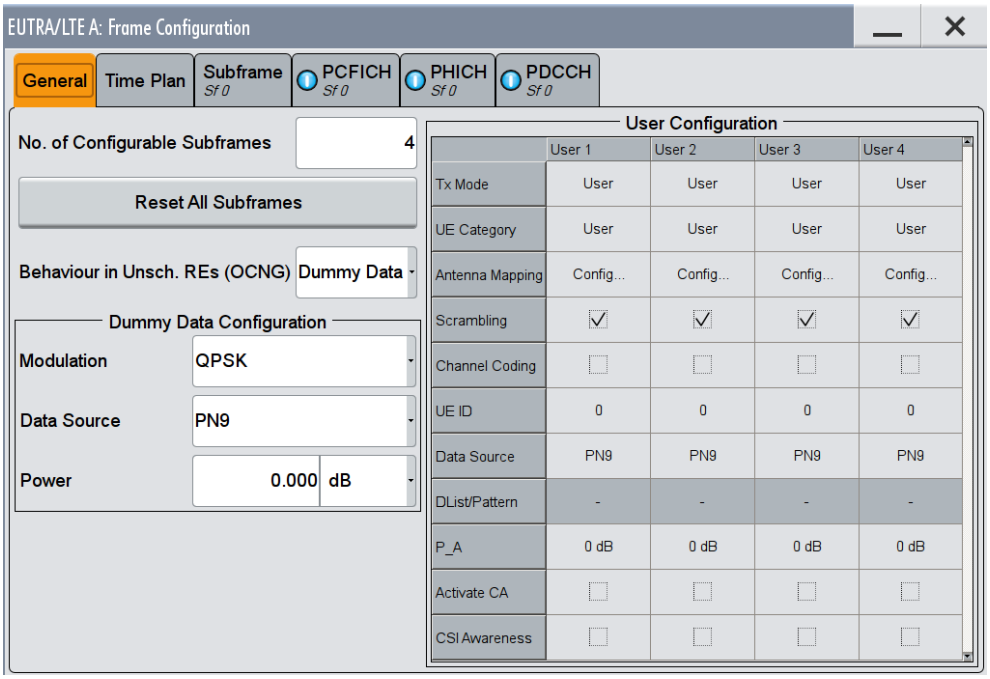
**Power (Dummy Data)**
Sets the power of the subcarriers allocated with dummy data.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:DUMD:POWer` on page 513

### 7.11.3 User Configuration Settings

1. To access this dialog, select "General > Link Direction > Downlink (OFDMA)"

2. Select "Frame Configuration > General > User Configuration"




This settings allow you to define and configure up to four scheduled user equipments that can be freely distributed over the whole frame by setting the data source of a certain allocation to "User 1 .. 4"

Using this feature ensures that a common data source is used for allocations of one user equipment also in case that these allocations are non-adjacent.

Following settings are identical for all allocations belonging to the same user in one subframe:

- Modulation - changing the modulation of one of the allocations belonging to a user changes the modulation of all other allocations of the same user in the subframe. Different modulations may be selected for the two code words of an allocation.

| | CW | Modulation | Enhanced Settings | VRB Gap | No. RB | No. Sym. | Offset RB | Offset Sym. | Auto | Phys. Bits | Data Source | DList / Pattern | ρ A /dB | Content Type | State | Conflict |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1/1 | QPSK | Config... | - | 6 | 4 | 22 | 7(1/0) | ☐ | 480 | MIB | - | 0.000 | PBCH | On | |
| 1 | 1/1 | QPSK | | - | 50 | 2 | 0 | 0(0/0) | ☐ | - | PDCCH | - | 0.000 | PDCCH | Off | |
| 2 | 1/1 | QPSK | Config... | - | 1 | 12 | 0 | 2(0/2) | ☑ | 256 | PN9 | - | 0.000 | PDSCH | On | |
| 3 | 1/1 | QPSK | Config... | - | 1 | 12 | 1 | 2(0/2) | ☑ | 512 | PN9 | - | 0.000 | PDSCH | On | |
| 4.1 | 1/2 | 16QAM | Config... | - | 1 | 12 | 2 | 2(0/2) | ☑ | 1024 | User3 | - | 0.000 | PDSCH | On | |
| 4.2 | 2/2 | QPSK | Config... | - | 1 | 12 | 2 | 2(0/2) | ☑ | 512 | | - | | | On | |
| 5.1 | 1/2 | 16QAM | Config... | - | 1 | 12 | 3 | 2(0/2) | ☑ | 1024 | User3 | - | 0.000 | PDSCH | On | |
| 5.2 | 2/2 | QPSK | Config... | - | 1 | 12 | 3 | 2(0/2) | ☑ | 512 | | - | | | On | |

- Complete Precoding Settings - changing the precoding settings of one of the allocations belonging to a user changes the precoding settings of all other allocations of the same user in the subframe.

- Scrambling Settings (Scrambling State and UE ID/n_RNTI) and Channel Coding State - changing the scrambling settings and the channel coding state for one user changes the scrambling settings and the channel coding state of all allocations of the same user in the frame. The Scrambling State, UE ID/n_RNTI and Channel Coding State are also displayed in the "Enhanced Settings" dialog of each allocation.

For more details, see chapter 4.9, "Data Allocations", on page 46.

**User (Configure User)**
Displays the consecutive number of the users.

Remote command:
n.a.

**Tx Mode**
(enabled for "Auto/DCI" scheduling mode)

Sets the transmission mode of the according user as defined in 3GPP TS 36.213, section 7.1.

Tx Mode 8 requires the additional SW option R&S SMW-K84.

Depending on the selection here, only valid DCI formats can be set for this user. According to the selected "Tx mode" and the selected "DCI format", the "Precoding" for the according PDSCH allocation is set automatically. If no Tx mode is selected, i.e. "-" is set, the range for valid DCI formats is not affected

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:TXM` on page 436

**UE Category**
Sets the UE Category.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:UEC` on page 437

**Configure Ant. Mapping**
For "Tx Mode > Tx Mode 7/Tx Mode 8/User", use the Antenna Port Mapping Settings dialog to define the mapping of the logical antenna ports to the available physical Tx antennas.

**State Scrambling (User)**
Enables/disables scrambling for all allocations belonging to the selected user.

The "Scrambling State" ("Enhanced Settings" menu) of all allocations for which "User 1..4" is selected as Data Source, is set to the value set with this parameter.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SCRambling:STATe` on page 510

**State Channel Coding (User)**
Enables/disables channel coding for all allocations belonging to the selected user.

The "Channel Coding State" ("Enhanced Settings" menu) of all allocations for which "User 1..4" is selected as Data Source, is set to the value set with this parameter.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CCODing:STATe on page 510

**UE ID (User)**
Sets the user equipment ID. This UE ID will be used for the generation of the scrambling sequence for the allocation, for which an "User 1..4" is selected as Data Source in the allocation table of DL Frame Configuration Settings dialog.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:UEID on page 510

**Data Source (User)**
Selects the data source for the selected user.

"Data lists" can be generated internally in the data editor or externally.

Data lists are selected in the "File Select" window, which is called by means of the "Data List Management" button.

If the "Pattern" data type is used, the bit pattern is defined in the "Pattern" input box. The length is limited to 64 bits.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:DATA on page 511

**DList Pattern (User)**
Displays the bit pattern or selected DLISt data, depending on the selected data source.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:DSELect on page 511
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:PATTern on page 512

**P_A**
Sets PDSCH power factor according to 3GPP TS 36.213, chapter 5.2.

This power value is applied to all allocations that belong to the corresponding user. The power of an allocation is additionally determined by the parameter "PDSCH Scheduling Mode". In a normal operation, the power values in the allocation table are configurable parameters. In the Auto/DCI mode however, the power value is fixed and cannot be adjusted.

For the DCI format 1D, an additional level offset has to be considered.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:PA on page 511

**Activate CA**
Requires software option R&S SMW-K85 (LTE-A Rel. 10)

Enables/disables carrier aggregation for the selected user.

If Activate Carrier Aggregation is enabled, carrier aggregation is activated automatically for all users, but can be deactivated afterwards.

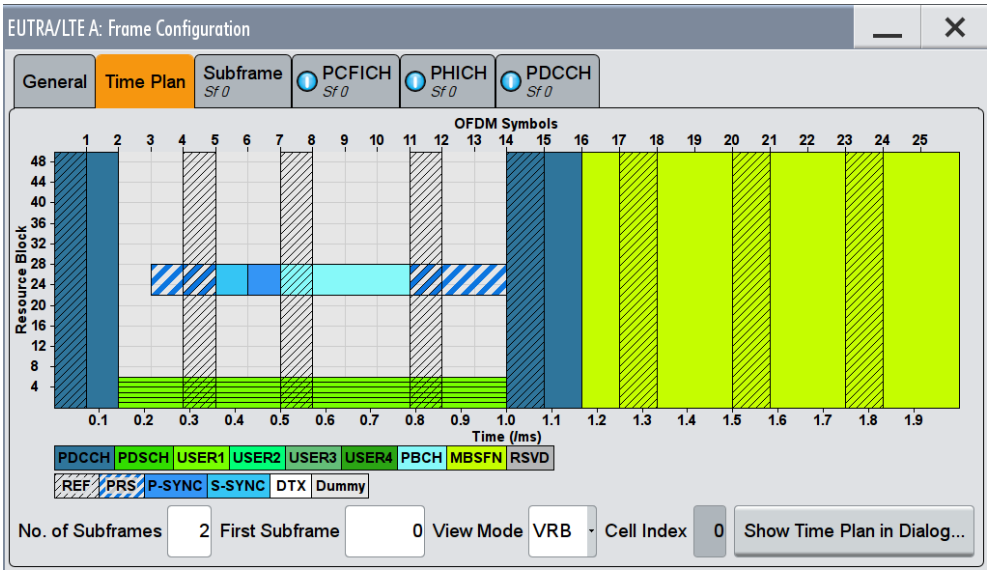
Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CA:STATe on page 512

**CSI Awareness**
Enables/disables the CSI awareness for the selected user, i.e. informs the UE that a CSI-RS are transmitted. See also chapter 3.2.5.5, "CSI reference signals", on page 28.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CAW:STATe on page 512

## 7.11.4 OFDMA Timeplan

1. To access this dialog, select "General > Link Direction > Downlink (OFDMA)".
2. Select "Frame Configuration > Time Plan".




The x-axis shows allocation in the time domain. The y-axis shows the resource blocks as smallest allocation granularity in the frequency domain. One allocation to a UE can span 1 to up to "No. of Resource Blocks" in the frequency domain.

P-SYNC/S-SYNC is automatically calculated according to the settings in General DL Settings dialog.

**First Subframe**
Selects the first subframe to be displayed.

Remote command:
n.a.

**No. of Subframes**
Selects the number of subframes to be displayed.

Remote command:
n.a.

**View Mode**
Determines whether the time plan shows the allocated Virtual Resource Blocks (VRBs) or the Physical Resource Blocks (PRBs).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:VIEW:MODE` on page 427

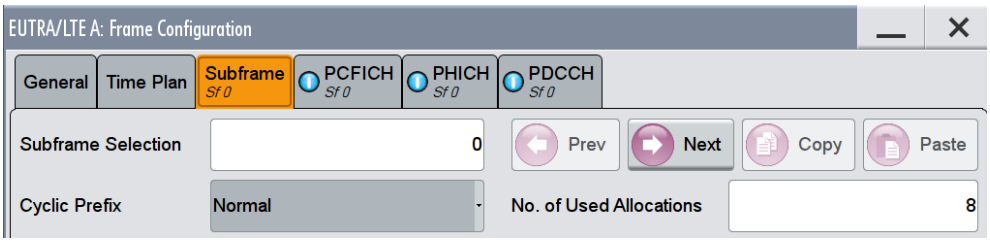
**Cell Index**
In enabled "General DL Settings > CA > Activate Carrie Aggregation > On" state, determines the time plan of which cell index (i.e. component carrier) is displayed.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:VIEW:CINDex` on page 450

**Show Time Plan in Dialog**
Enlarges the time plan display.

## 7.11.5 Subframe Configuration Settings

1. To access this parameters, select "General > Link Direction > Downlink (OFDMA)".
2. Select "Frame Configuration".
3. To access the common subframe configuration settings, select one of the following:
   - "Frame Configuration > Subframe"
   - "Frame Configuration > PCFICH"
   - "Frame Configuration > PHICH"
   - "Frame Configuration > PDCCH"




Provided are the following common settings:

**Subframe Selection**
Sets the subframe to be configured in the frame configuration table.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:SFSelection` on page 428

**Cyclic Prefix**
Configuration of the cyclic prefix per subframe is only enabled, if the parameter Cyclic Prefix is set to User Defined.

The number of the OFDM symbols per subframe is set automatically.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:CYCPrefix` on page 428

**No. Of Used Allocations**
Sets the number of scheduled allocations in the selected subframe.

The number of available allocations depends on the allocation's content type for a subframe and the general channel bandwidth setting.

The default value depends on the existence of a PBCH channel in a subframe. In this case the default value is set to 2, otherwise to 1; the second respectively the first allocation is reserved for the PDCCH, regardless whether this allocation is enabled or not.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALCount` on page 429

**Copy/Paste**
Copies/pastes the settings of the selected subframe. P-SYNC/S-SYNC/PBCH settings are not considered.

For more detailed information, see chapter 5.2.1, "Copy/Paste Subframe", on page 55.

Remote command:
n.a.

**Next/Prev**
Navigates through the subframes.

Remote command:
n.a.

### 7.11.6 DL Resource Allocation Table

1. To access this dialog, select "General > Link Direction > Downlink (OFDMA)".

2. Select "Frame Configuration > Subframe".

| | CW | Modu-lation | Enhanced Settings | VRB Gap | No. RB | No. Sym. | Offset RB | Offset Sym. | Auto | Phys. Bits | Data Source | DList / Pattern | ρ A /dB | Content Type | State | Con-flict |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1/1 | QPSK | Config... | - | 6 | 4 | 22 | 7(1/0) | ☐ | 480 | MIB | - | 0.000 | PBCH | On | |
| 1 | 1/1 | QPSK | | - | 50 | 2 | 0 | 0(0/0) | ☐ | - | PDCCH | - | 0.000 | PDCCH | Off | |
| 2 | 1/1 | 16QAM | Config... | - | 1 | 12 | 0 | 2(0/2) | ☑ | 512 | PN11 | - | 5.000 | PDSCH | On | |
| 3 | 1/1 | 64QAM | Config... | - | 1 | 12 | 1 | 2(0/2) | ☑ | 1536 | PN9 | - | 0.000 | PDSCH | On | |
| 4.1 | 1/2 | 16QAM | Config... | - | 1 | 12 | 2 | 2(0/2) | ☑ | 1024 | User1 | - | 0.000 | PDSCH | On | |
| 4.2 | 2/2 | QPSK | Config... | - | 1 | 12 | 2 | 2(0/2) | ☑ | 512 | | - | | | On | |
| 5.1 | 1/2 | QPSK | Config... | - | 1 | 12 | 3 | 2(0/2) | ☑ | 512 | PN9 | - | 0.000 | PDSCH | On | |
| 5.2 | 2/2 | QPSK | Config... | - | 1 | 12 | 3 | 2(0/2) | ☑ | 512 | | - | | | On | |

The resource allocation table comprises the settings necessary to configure the individual allocation parameters for a subframe.

**Allocation number**
Displays the consecutive number of the allocation.

Remote command:
n.a.

**Codeword**
Determines whether one or two codewords use the same physical resource, and whether codeword #1 or #2 is configured with this allocation table entry

In case the data source for an allocation is set to User, changing this parameter will set also the parameter "Code Word" of all allocations, belonging to the same User in the corresponding subframe.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>:CODWords`
on page 429

**Mod.**
Selects the modulation scheme for the allocation.

In case the data source for an allocation is set to User, changing this parameter will set also the parameter "Modulation" of all allocations, belonging to the same User in the corresponding subframe.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:MODulation`
on page 430

**Enhanced Settings DL**
Calls the "Enhanced Settings" dialog for configuration of precoding and channel coding (see chapter 7.12, "Enhanced PBCH, PDSCH and PMCH Settings", on page 188).

Remote command:
n.a.

**VRB Gap**
Enables the utilization of Virtual Resource Blocks (VBR) of distributed type and determines whether the first or the second gap is applied, i.e. determines the distribution and the mapping of the VRB pairs to the Physical Resource Blocks (PRB) pairs.

The VRB-to-PRB mapping and the calculation of the VRB gap values are performed according to 3GPP TS 36.211. The specification defines two types of VRBs, a localized distribution with a direct mapping and distributed VRBs for better frequency diversity. The distribution of the VRBs is performed in such a way, that consecutive VRBs are not mapped to frequency-consecutive PRBs, i.e. the VRBs are spread over the frequencies. Each single VRB pair is split into two parts and a frequency gap between these two VRB parts is introduced, i.e. a frequency hopping on a slot basis is applied. For wider channel bandwidths (more than 50 RBs), a second VRB gap with smaller size may be applied.

**Tip:** Use the "DL Time Plan" to visualize the PDSCH mapping.

The information whether localizated or distributed VBRs are applied is carried by the PDCCH. The DCI Formats 1A/1B/1D provide the special 1-bit flag "Localized/Distributed VBR Assignment" for this purpose. The selection whether the first or the second gap is applied, is determined by the additional bit "Gap Value".

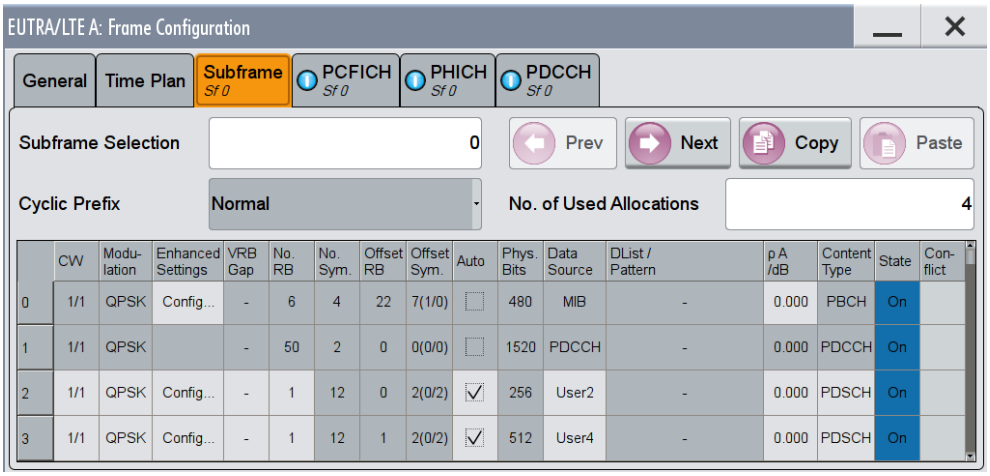
**Note:** In case a Auto DCI mode is used, the "VRB Gap" value is read-only and is set according to the configuration of the corresponding DCI format.

**Example:**

"DL Channel Bandwidth" = *10 MHz* (50 RBs)

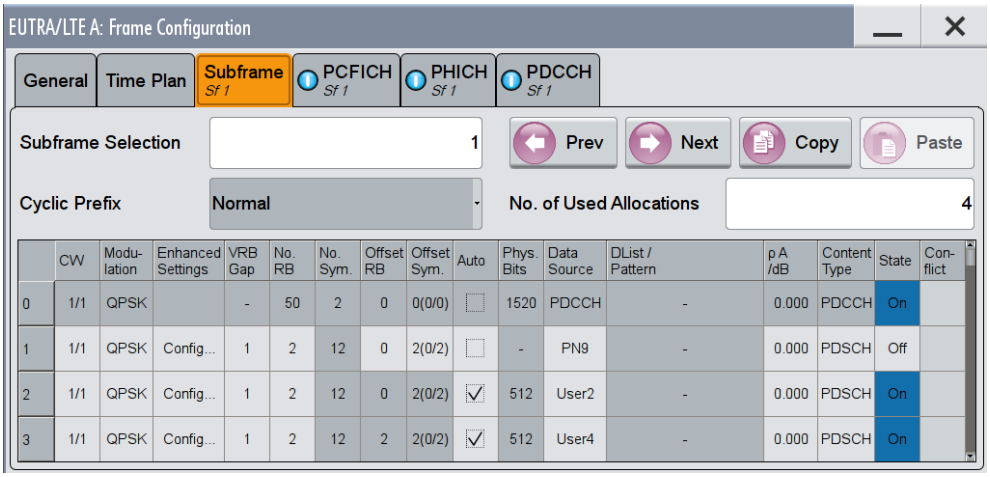
Three subframes are configured:

- Subframe#0
  PDSCH allocaton#2 (User2): "VRB Gap" = *0*
  PDSCH allocaton#3 (User4): "VRB Gap" = *0*



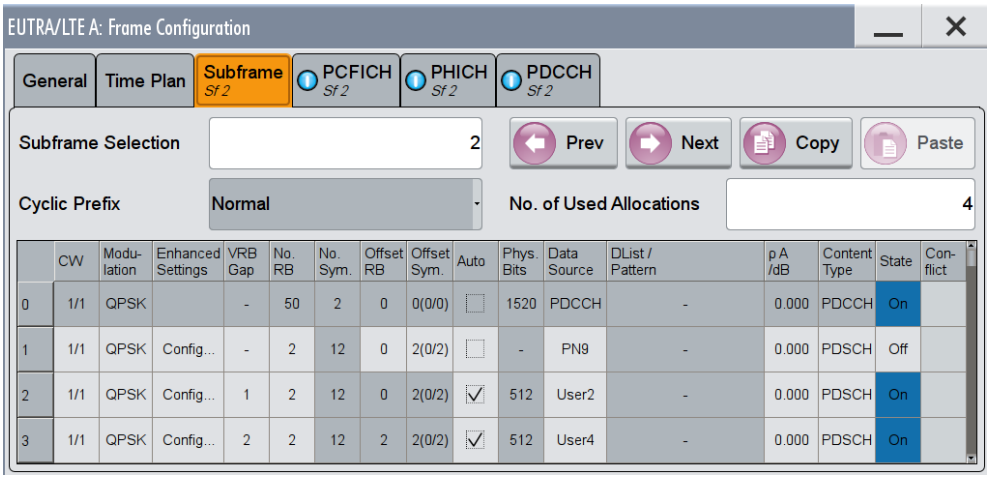

| | CW | Modu-lation | Enhanced Settings | VRB Gap | No. RB | No. Sym. | Offset RB | Offset Sym. | Auto | Phys. Bits | Data Source | DList / Pattern | ρ A /dB | Content Type | State | Con-flict |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1/1 | QPSK | Config... | - | 6 | 4 | 22 | 7(1/0) | ☐ | 480 | MIB | - | 0.000 | PBCH | On | |
| 1 | 1/1 | QPSK | | - | 50 | 2 | 0 | 0(0/0) | ☐ | 1520 | PDCCH | - | 0.000 | PDCCH | On | |
| 2 | 1/1 | QPSK | Config... | - | 1 | 12 | 0 | 2(0/2) | ☑ | 256 | User2 | - | 0.000 | PDSCH | On | |
| 3 | 1/1 | QPSK | Config... | - | 1 | 12 | 1 | 2(0/2) | ☑ | 512 | User4 | - | 0.000 | PDSCH | On | |

- Subframe#1
- PDSCH allocaton#2 (User2): "VRB Gap" = *1*
  PDSCH allocaton#3 (User4): "VRB Gap" = *1*
  Both allocations use distributed VRBs; the first VRB gap is applied.
  According to TS 36.211, the 1st VRB gap for 10 MHz channel bandwidth is **27 RBs**




| | CW | Modu-lation | Enhanced Settings | VRB Gap | No. RB | No. Sym. | Offset RB | Offset Sym. | Auto | Phys. Bits | Data Source | DList / Pattern | ρ A /dB | Content Type | State | Con-flict |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1/1 | QPSK | | - | 50 | 2 | 0 | 0(0/0) | ☐ | 1520 | PDCCH | - | 0.000 | PDCCH | On | |
| 1 | 1/1 | QPSK | Config... | 1 | 2 | 12 | 0 | 2(0/2) | ☐ | - | PN9 | - | 0.000 | PDSCH | Off | |
| 2 | 1/1 | QPSK | Config... | 1 | 2 | 12 | 0 | 2(0/2) | ☑ | 512 | User2 | - | 0.000 | PDSCH | On | |
| 3 | 1/1 | QPSK | Config... | 1 | 2 | 12 | 2 | 2(0/2) | ☑ | 512 | User4 | - | 0.000 | PDSCH | On | |

- Subframe#2
  PDSCH allocaton#2 (User2): "VRB Gap" = *1*
  PDSCH allocaton#3 (User4): "VRB Gap" = *2*
  Both allocations use distributed VRBs; the first VRB gap is applied for PDSCH allocation#2 (User2) and the second VRB gap for the allocation#3 (User4) .
  According to TS 36.211, the 2nd VRB gap for 10 MHz channel bandwidth is **9 RBs**




Use the "DL Time Plan" to visualize the PDSCH mapping.

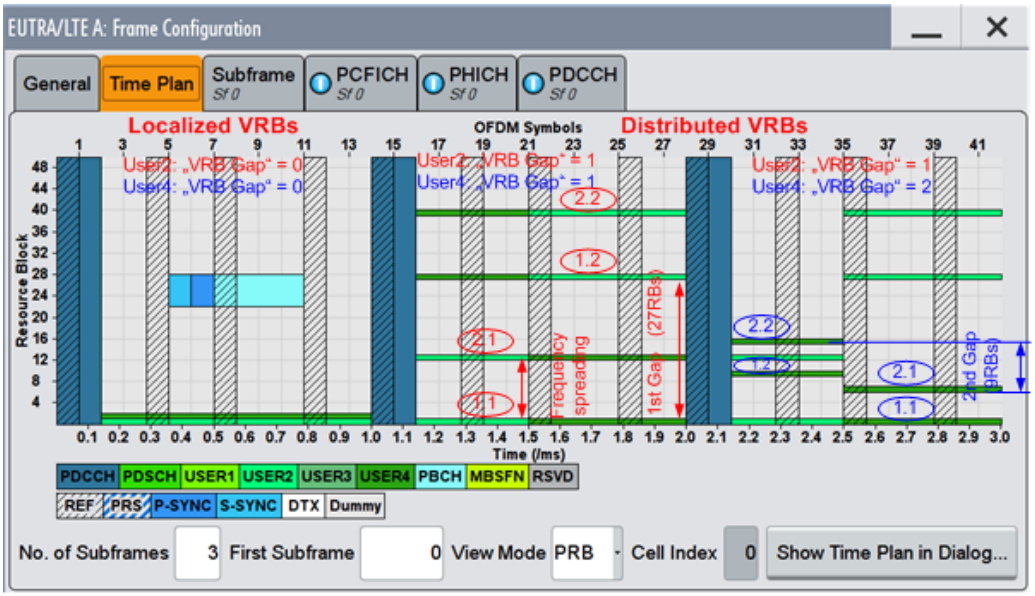



***Fig. 7-12: DL Time Plan***

Subframe#0 = Localized VRB, direct mapping VRB-to-PRB
Subframe#1 = Distributed VRB: 1st Gap=27 RBs applied for User2 and User4
1.1 , 1.2 = 1. VRB pair part 1 and part 2
2.1 , 2.2 = 2. VRB pair part 1 and part 2
Subframe#2 = Distributed VRB: 1st Gap=27 RBs applied for User2, 2nd Gap=9RBs applied for User4

"0" A **localized distribution** is applied, i.e. the PDSCH mapping is performed on a direct VRB-to-PRB mapping.

"1" Enables a **distributed** resource block allocation. The first VRB gap is used.

"2" Enabled for "Channel Bandwidths" grater than 50 RBs.
The mapping is based on the second (smaller) VRB gap.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:GAP`
on page 430

**No. RB (Resource Blocks)**
Defines bandwidth of selected allocation in terms of resource blocks per slot.

In case two codewords are configured, the defined bandwidth of the allocation with the second codeword is determinate by the selected bandwidth of the first one.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:RBCount` on page 431

**No. Sym.**
Sets the size of the selected allocation in OFDM symbols.

For FDD mode and content type PDSCH, this value is set automatically in a way that the allocation always fills the complete subframe with consideration of the symbol offset.

**Example:**
For Cyclic Prefix with normal length (14 OFDMA Symbols) and Symbol Offset = 2 the resulting No. Of Symbols is 12.

In case two codewords are configured, the size of the allocation with the second codeword is determinate by the size of the first one.

While configuring a special subframe for TDD mode, the maximum size of the PDSCH allocation is determined by the selected TDD Frame Structure Settings and depends on the selected Cyclic Prefix.

The table below shows the cross-reference between the special subframe configuration and the maximum number of OFDM symbols available for PUSCH (DwPTS) in a special subframe for normal and extended CP respectively.

| Configuration of Special Subframe | DwPTS (Normal CP) | DwPTS (Extended CP) |
|---|---|---|
| 0 | 3 | 3 |
| 1 | 9 | 8 |
| 2 | 10 | 9 |
| 3 | 11 | 10 |
| 4 | 12 | 3 |
| 5 | 3 | 8 |
| 6 | 9 | 9 |
| 7 | 10 | - |
| 8 | 11 | - |

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SYMCount` on page 431

**Offs RB**
Sets the start resource block of the selected allocation.

**Note:** If the "Auto Offset Calculation" mode is activated, this value is read only.

In case two codewords are configured, the start resource block of the allocation with the second codeword is determinate by the selected start resource block of the first one.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:RBOFfset` on page 432

**Offs Sym.**
Sets the start OFDM symbol of the selected allocation.

**Note:** If the "Auto Offset Calculation" mode is activated, this value is read only.

For extended cyclic prefix, the maximum symbol offset is 13.

**Note:** According to 3GPP TS 36.211, up to first three OFDM symbols of a subframe are reserved for control information (PDCCH). Therefore, for PDSCH allocations the maximum value is 3, regardless of the cyclic prefix length.

In case two codewords are configured, the start OFDM symbol of the allocation with the second codeword is determinate by the selected start OFDM symbol of the first one.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SYMoffset` on page 432

**Auto**
Sets whether automatic offset calculation is used or not.

**Note:** If the "Auto Offset Calculation" mode is activated, the resource block offset and the start symbol offset are set automatically and cannot be changed.

By setting new allocations or changing the number of RBs of an existing allocation, the Auto mode tries to distribute the allocations with activated Auto mode in an optimal manner to the available resource blocks by adjusting the parameters "Offset RB". The resulting "No. of Bits" of a certain allocation can vary, due to overlapping control channels.

If it is not possible to distribute the changed configuration to the available resources blocks, a conflict is displayed.

**Note:** "Auto Offset Calculation" mode is only available for PDSCH. For PDCCH this parameter is always off.

In case two codewords are configured, the state of the "Auto Offset Calculation" mode of the second codeword is set to the state of the first one.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:AOC` on page 433

**Phys. Bits**
Displays the size of the selected allocation in bits and considering the subcarriers that are used for other signals or channels with higher priority (see chapter 5.1, "Conflict Handling in the R&S Signal Generator", on page 51 ).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PHYSbits?` on page 433

**Data Source**
Selects the data source for the selected allocation.

"Data lists" can be generated internally in the data editor or externally.

Data lists are selected in the "File Select" window, which is called by means of the "Data List Management" button.

If the "Pattern" data type is used, the bit pattern is defined in the "Pattern" input box. The length is limited to 64 bits.

Data sources for "User 1 .. 4" can be configured in the User Configuration Settings dialog.

For PBCH allocation with enabled parameter MIB (including SFN), the "Data Source" is automatical set to "MIB".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:DATA` on page 434

**DList/Pattern**
Displays the bit pattern or selected DLISt data, depending on the selected data source.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:DSELect` on page 434
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PATTern` on page 434

**Rho A**
Sets the power $P_{PDSCH}$ respectively $P_{PBCH}$ for the selected allocation.

The power of the PDCCH allocation $P_{PDCCH}$ is read-only. The value is set in the "Enhanced Channel Configuration" dialog of the corresponding subframe.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:POWer` on page 435

**Content Type**
Selects the type of the selected allocation.

**Note:** There can be only one PBCH in subframe 0.

The reserved channel (RSVD) can be used for simulating possible upcoming channel types.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CONType` on page 435

**State**
Sets the allocation to active or inactive state.

In case two codewords are configured, the state of the allocation with the second codeword is determinate by the state of the first one.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:STATe` on page 436

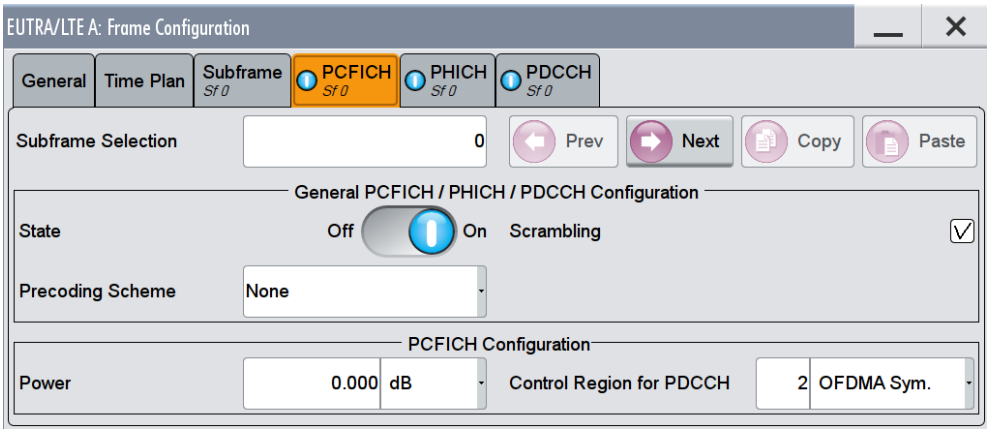
**Conflict**
Indicates a conflict between allocations.

For more information, see chapter 5.1, "Conflict Handling in the R&S Signal Generator", on page 51.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CONFlict` on page 436

## 7.11.7 PCFICH Settings

1. To access this dialog, select "General > Link Direction > Downlink (OFDMA)".
2. Select "Frame Configuration > PCFICH".




This dialog comprises the settings required for configuring PCFICH.

Provided are the following settings:

**General PCFICH/PHICH/PDCCH Configuration**
Comprisses the settings common to all DL enhanced channels.

**State ← General PCFICH/PHICH/PDCCH Configuration**
Enables/disables the PDCCH, PCFICH and PHICH allocation.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:STATe` on page 464

**Precoding Scheme ← General PCFICH/PHICH/PDCCH Configuration**
Selects the precoding scheme for PDCCH, PCFICH and PHICH.

"None" Disables precoding.

"Tx Diversity" Precoding for transmit diversity will be performed according to 3GPP TS 36.211 and the selected parameters.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PRECoding:SCHeme`
on page 464

**Number of Layers (Enhanced Channels) ← General PCFICH/PHICH/PDCCH Configuration**
(Enabled for Precoding Scheme set to Tx Diversity)

Displays the number of layers for PDCCH, PCFICH and PHICH. This value is fixed to 1 for PDCCH, PCFICH and PHICH.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PRECoding:NOLayers?`
on page 465

**Scrambling State ← General PCFICH/PHICH/PDCCH Configuration**
Enables/disables the scrambling of the PCFICH.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PCFich:SCRambling:STATe` on page 466

**PCFICH Power**
Sets the power of the PCFICH ($P_{PCFICH}$).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PCFich:POWer`
on page 465

**Control Region for PDCCH**
Sets the size of the control region, i.e. the number of OFDM Symbols that he region spans.

Whether 1, 2, 3 or 4 OFDM Symbols can be reserved for PDCCH depends on the parameters given in the following table.

| Channel Bandwidth | PHICH Duration | Duplex. Mode | OFDM Symbols in | the control region |
|---|---|---|---|---|
| | | | Normal Subframe | Special Subframe |
| No RB > 10 | Normal | FDD | 1,2,3 | - |
| | Normal | TDD | 1,2,3 | 1,2 |
| | Extended | FDD | 3 | - |
| | Extended | TDD | 3 | 2 |
| No RB <=10 | Normal | FDD | 2,3,4 | - |
| | Normal | TDD | 2,3,4 | 2 |
| | Extended | FDD | 3,4 | - |
| | Extended | TDD | 3,4 | 2 |

The size of the control region can vary per subframe.

Remote command:

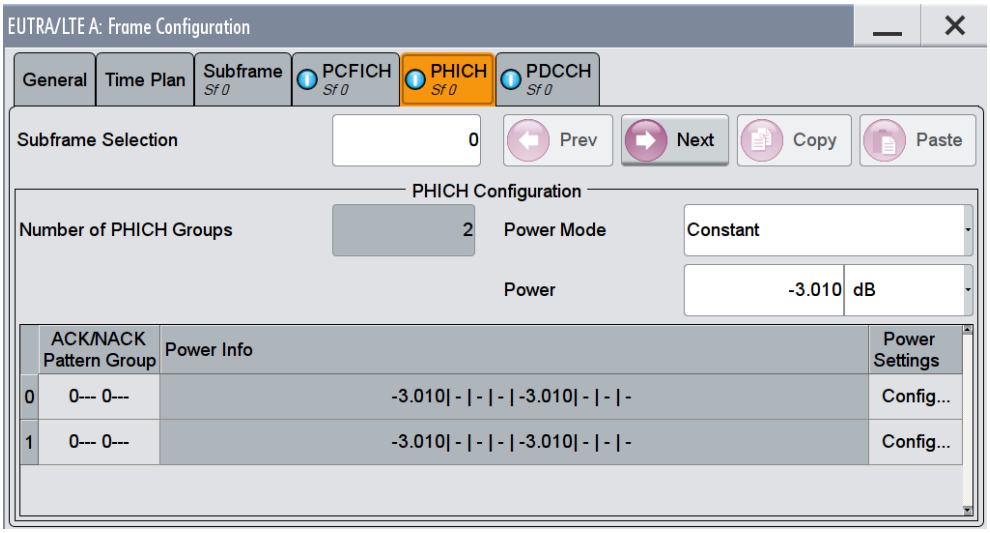
`[:SOURce<hw>]:BB:EUTRa:DL:BW` on page 404

`[:SOURce<hw>]:BB:EUTRa:DL:PHICh:DURation` on page 410

`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PCFich:CREGion` on page 466

## 7.11.8 PHICH Settings

1. To access this dialog, select "General > Link Direction > Downlink (OFDMA)".
2. Select "Frame Configuration > PHICH".




This dialog comprises the settings required for configuring PHICH.

Provided are the follwoing settings:

**Number of PHICH Groups**
Displays the number of available PHICH groups, depending on the value of the parameter PHICH N_g.

This parameter is enabled for configuration only if the parameter "PHICH N_g" is set to "Custom".

- For normal CP, one PHICH group consists of 8 ACK/NACK messages from several users.
- For extended CP, 4 ACK/NACK messages from several users are carried by on PHICH group.

Each PHICH group uses 3 resource element groups (REGs); hence the total number of REGs used for PHICH is 3 times the number of PHICH groups.

The number of the available OFDM symbols for the allocation of this total number of REGs depends on the selection made for the parameter PHICH Duration (normal or extended).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh:NOGRoups` on page 468

**Power Mode**
Determines whether all PHICH in a PHICH group are send with the same power or enables the adjustment of each $P_{PHICH}$ individualy.

The parameter Power Info displays the power values of the configured PHICHs.

"Constant" The power of a PHICH ($P_{PHICH}$) in a PHICH group is set with the parameter Power.

"Individual" The power of the individual PHICHs is set in the PHICH Power Config dialog.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh:PMODe` on page 467

**PHICH Power**
Sets the power of one PHICH ($P_{PHICH}$) in a PHICH group, i.e. the total power of one PHICH group is the sum of the power of the transmitted PHICHs within this group.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh:POWer` on page 467

**ACK/NACK Pattern Group 0 .. 9**
Sets the ACK/NACK pattern for the corresponding PHICH group.

A "1" indicates an ACK, a "0" - a NACK, a "-" indicates DTX.

DTX means that the corresponding PHICH is not transmitted, i.e. the orthogonal sequence is not used.

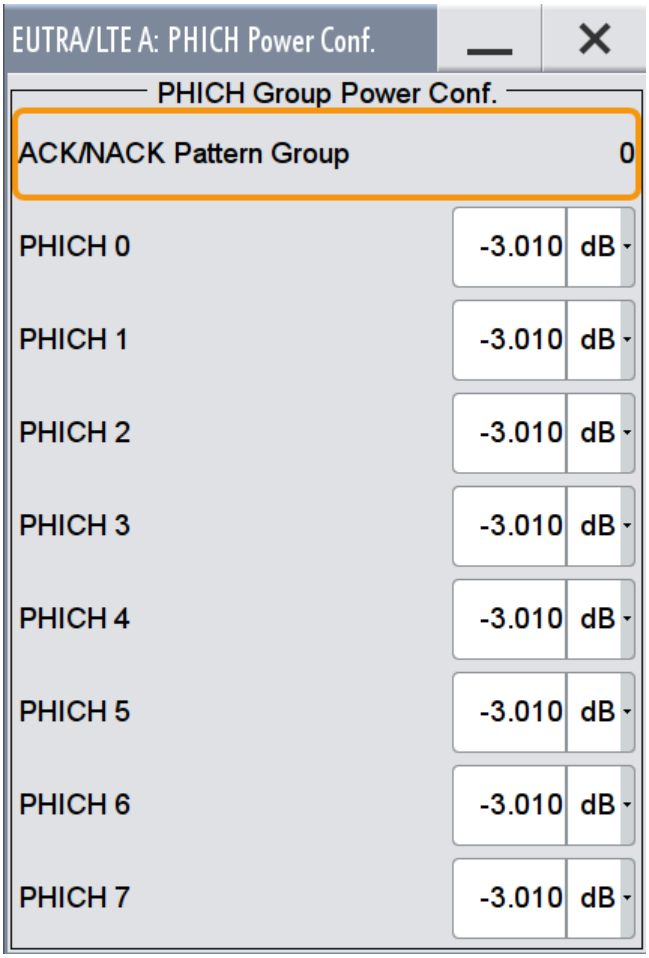
Since the number of ACK/NACK messages carried by a PHICH group depends on the Cyclic Prefix, a pattern group consists of 8 or 4 values for normal and extended CP respectively.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh:ANPattern<ch0>` on page 468

**Power Info**
Displays the power values of the configured PHICHs.

Remote command:
n.a.

**Power Settings Config.**
Opens the "PHICH Power Config". dialog to configure the power of the PHICHs individualy.


EUTRA/LTE A: PHICH Power Conf.
PHICH Group Power Conf.
ACK/NACK Pattern Group 0
PHICH 0 -3.010 dB
PHICH 1 -3.010 dB
PHICH 2 -3.010 dB
PHICH 3 -3.010 dB
PHICH 4 -3.010 dB
PHICH 5 -3.010 dB
PHICH 6 -3.010 dB
PHICH 7 -3.010 dB

"ACK/NACK Pattern Group" Displays the ACK/NACK pattern group the values are adjusted for.

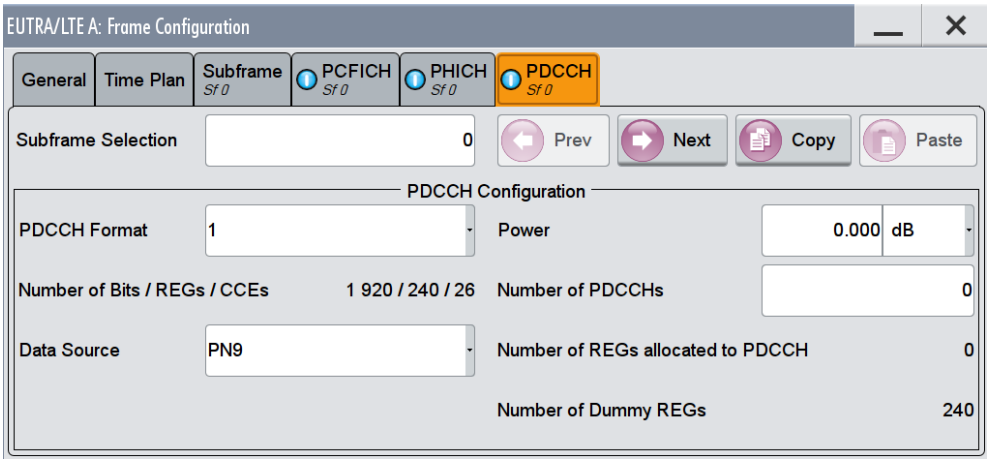
"PHICH 0..7" Sets the power of the individual PHICHs

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh:GROup<ch0>:ITEM<user0>:POW` on page 467

## 7.11.9 PDCCH Settings

1. To access this dialog, select "General > Link Direction > Downlink (OFDMA)".

2. Select "Frame Configuration > PDCCH".




This dialog comprises the settings required for configuring PDCCH.

Provided are the following settings:

**PDCCH Power**
Sets the power of the PDCCH (PPDCCH).

The value set with this parameter is also displayed in the allocation table for the corresponding allocation.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:POWer` on page 468

**Number of Bits / REGs / CCEs (PDCCH)**
Displays the number of bits / REGs / CCEs allocated for PDCCH.

The number of bits available for PDCCH allocation depends on the selected:
- Channel Bandwidth
- Global MIMO Configuration
  Number of PHICH Groups
- PHICH Duration
- Control Region for PDCCH

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:BITS` on page 469

**Number of available REGs (PDCCH)**
Defines the number of the REGs that are available for the PDCCH allocation.

The number of REGs available for PDCCH allocation depends on the Number of Bits available for PDCCH ($\#Bits_{PDCCH}$) and is calculated as follow:

$\#REGs\ available_{PDCCH} = \#Bits_{PDCCH} / 8$

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:AVRegs`
on page 469

**Number of available CCEs (PDCCH)**
Defines the number of the control channel elements (CCEs) that are available for the PDCCH allocation.

The PDCCH is mapped to the REGs not used for PHICH and PCFICH and transmitted on one or several CCEs, where a CCE corresponds to 9 REGs, i.e. the number of the available CCEs is calculated as follow:

#CCEs available$_{PDCCH}$ = #REGs available PDCCH / 9

**Note:** If "Activate Carrier Aggregation > ON", the paramter "Number of available CCEs (PDCCH)" displays information about the PCell.
Information related to the SCells is displayed by the corresponding parameter Number of Dummy CCEs.

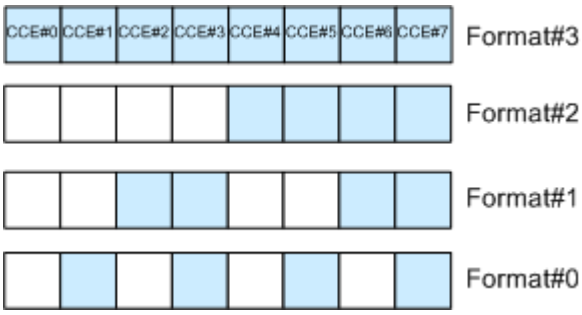
Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:AVCCes`
on page 470

**PDCCH Format**
Sets the PDCCH format.

The PDCCH format determines how many CCEs (control channel elements) will be used for the transmission of the PDCCH, i.e. determines how many PDCCHs (#PDCCH) can be transmitted.

The table below gives an overview of the supported PDCCH Formats, as defined in the 3GPP specification.

The figure below shows the distribution of the PDCCH over the CCEs for the different formats.




"Variable" Select this mode to enable full flexibility by the configuration of the downlink control information (DCI) format and content (see chapter 7.11.10, "PDCCH Format Variable", on page 170).

"-1" R&S Signal Generator's proprietary format for legacy support.

This format corresponds to the transmission of one PDCCH on all available REGs, i.e.

- REGs available PDCCH = #REGs allocated PDCCH,
- #PDCCH = 1,
- #DummyREGs = 0.

"0" One PDCCH is transmitted on one CCE, i.e. #REG=1.

"1" One PDCCH is transmitted on two CCEs, i.e. #REG=18.

"2" One PDCCH is transmitted on four CCEs, i.e. #REG=36.

"3" One PDCCH is transmitted on eight CCEs, i.e. #REG=72.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:FORMat` on page 470

**Number of PDCCHs**
(for "PDCCH Format" different than "Variable")

Sets the number of PDCCHs to be transmitted.

The maximum number PDCCH that can be transmitted on the available REGs for PDCCH depends on the number of REGs (#REG) reserved for the transmission of one PDCCH, i.e. depends on the selected PDCCH Format and is calculated as follow:

#PDCCH = REGs available PDCCH / #REG.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:NOPDcchs` on page 471

**Number of REGs allocated to PDCCH**
(for "PDCCH Format" different than "Variable")

Defines the number of REGs that are actually allocated for PDCCH transmission (#REGs $allocated_{PDCCH}$) and is calculated as follow:

#REGs $allocated_{PDCCH}$ = #PDCCH * #REG

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:ALRegs` on page 472

**Number of Dummy REGs**
(for "PDCCH Format" different than "Variable")

Displays the number of REGs that are available for the PDCCH allocation but are not allocated and is calculated as follow:

#DummyREGs = REGs available PDCCH - #REGs allocated PDCCH.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DREGs` on page 472

**Data Source (PDCCH)**
(for "PDCCH Format" different than "Variable")

Selects the data source for PDCCH.

Data lists can be generated internally in the data editor or externally and have to have a file extension `*.dm_iqd`.

Data lists are selected in the "File Select" window, which is called by means of the "Data List Management" button.

If the "Pattern" data type is used, the bit pattern is defined in the "Pattern" input box. The length is limited to 64 bits.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DATA on page 473

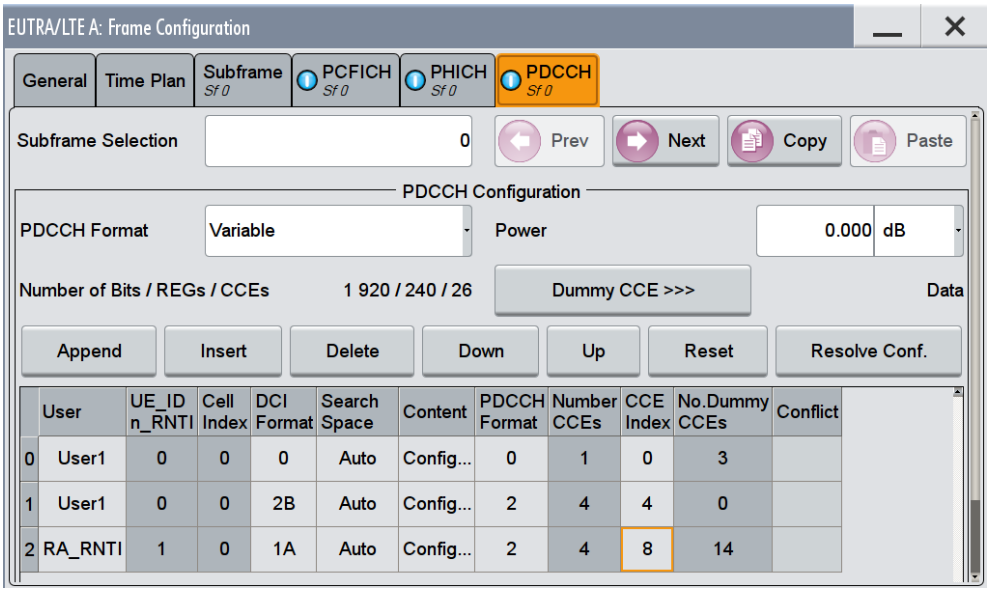
**DList/Pattern (PDCCH)**
(for "PDCCH Format" different than "Variable")

Displays the bit pattern or selected DLISt data, depending on the selected data source.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:PATTern
on page 473
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:PATTern
on page 473

## 7.11.10 PDCCH Format Variable

► To enable the setings described in this section, select "PDCCH Format > Variable".




Use these parameters and the DCI table to configure the multiple scheduling messages (DCIs) with the corresponding PDCCHs.

**Dummy CCE REGs**
Sets the behavior of the dummy REGs, i.e. determines whether dummy data or DTX is transmitted.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:TRSource
on page 474

**Dummy CCE Data Source**
Selects the data source for the dummy CCE.

"Data lists" can be generated internally in the data editor or externally and have to have a file extension `*.dm_iqd`.

Data lists are selected in the "File Select" window, which is called by means of the "Data List Management" button.

If the "Pattern" data type is used, the bit pattern is defined in the "Pattern" input box. The length is limited to 64 bits.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:DATA`
on page 474

**DList/Pattern (Dummy CCE)**
Displays the bit pattern or selected DLISt data, depending on the selected data source.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:PATTern`
on page 475
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:DSELect`
on page 474

**Append**
Adds a new row at the end of the table.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:APPend`
on page 476

**Insert**
Insert a new row before the current one.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:SITem`
on page 475
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:INSert`
on page 476

**Delete**
Deletes the selected row.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:SITem`
on page 475
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:DELete`
on page 476

**Down/Up**
Moves the selected row down or up.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:SITem
on page 475
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:DOWN
on page 476

**Reset**
Resets the table.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:RESet
on page 477

**Resolve Conflicts**
The "Resolve Conf." is a built-in algorithm that re-assigns automatically the CCE values depending on the configured "Search Space"; previously configured CCE values will not be maintained. If the conflict can not be resolved automatically, the values are left unchanged.

For more information on how to solve DCI conflicts, see chapter 5.1.3, "DCI Conflict Handling", on page 53.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:SOLVe?
on page 477

**DCI Table**
Comprises the settings concerning the PDCCH content.

**User ← DCI Table**
Selects the User the DCI is dedicated to. The available DCI Format depend on the value of this parameter.

**Note:** If "Activate Carrier Aggregation > ON", the Cell Index determines the component carrier the corresponding User is mapped to. To enable one particular User in more than one component carrier, append several table rows and enable the same User in the different component carriers.

| | |
|---|---|
| "User 1 .. 4" | Selects one of the four users configured in the User Configuration Settings dialog. |
| "P-RNTI/S-RNTI/RA-RNTI" | A group of users is selected. |
| "None" | Allows free definition of all settings |

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:USER on page 480

**UE_ID/n_RNTI ← DCI Table**
Displays the UE_ID or the n_RNTI for the selected PDCCH.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:UEID` on page 477

**Cell Index ← DCI Table**
Determines the component carrier the corresponding DCI is transmitted on.

This parameter refers to the "DL Carrier Aggregation Configuration > Cell Index". The "Cell Index" of the PCell (Primary Cell) is always set to 0.

**Example:**

If the following settings are enabled in the "DL Carrier Aggregation Configuration" dialog, the value range of the parameter "Cell Index" is 0, 1, 3, 5 and 7.

| Component Carrier | Cell Index |
|---|---|
| PCell | 0 |
| SCell#1 | 1 |
| SCell#2 | 3 |
| SCell#3 | 7 |
| SCell#4 | 5 |

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:CELL` on page 478

**DCI Format ← DCI Table**
Sets the DCI format for the selected PDCCH.

The downlink control information (DCI) is a message used to control the physical layer resource allocation in both the UL and DL direction and carries scheduling information as well as uplink power control commands. The DCI is mapped on the PDCCH and depending on the DCI message size and usage are categorized into four different formats that are further sub-divided (see table 7-10).

***Table 7-10: Overview DCI Formats***

| DCI Format | Purpose |
|---|---|
| DCI Format 0 | PUSCH allocation information |
| DCI Format 1<br>DCI Format 1A<br>DCI Format 1B<br>DCI Format 1C<br>DCI Format 1D | PDSCH information with one code word |

| DCI Format | Purpose |
|---|---|
| DCI Format 2/2A/2B | PDSCH information for MIMO configuration (two code words) |
| DCI Format 3/3A | Uplink power control information |

The fields of each DCI format are configurable parameters that can be adjusted in the corresponding dialog box. Select Content Config to access this dialog box for the selected "DCI Format".

Not all DCI Formats are always enabled for selection. The table below gives an overview of the cross-reference between the available DCI Formats and the selected User.

| User | DCI Format |
|---|---|
| P-RNTI/SI-RNTI/RA-RNTI | 1A, 1C |
| User 1..4 | 1, 1A, 1B, 1D, 2, 2A, 2B |
| None | All formats |

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIFmt` on page 477

**Search Space ← DCI Table**
Defines the search space for the selected DCI, i.e determines the valid CCE indexes.

The search space determines the set of CCEs a UE monitors. The UE can decode only the control information on a PDCCH that is transmitted over CCEs within the search space this UE monitors.

**Note:** The 3GPP specification defines two kinds of search spaces, the common and the UE-specific search space.
Avoid the use of the "Auto" and "Off" values; this values are provided for backwards compatibility reasons only.

"Off" No search space is determined, i.e. all CCEs have to be monitored.

"Auto" Provided for backward compatibility only.
An internal mapping to the common and UE-specific search space is applied depending on the selected user: for "User 1..4", "Auto" corresponds to "UE-spec"; in all other cases, "Auto" corresponds to "Common".

"Common" The DCI is mapped to the common search space.
A common search space is used when all or a group of UEs are addressed. The combination User 1 and common search space is enabled in PCell only.

"UE-spec" Non-common DCIs are mapped to the UE-specific search space. Each UE has multiple UE-specific search space, determined as a function of the UE_ID and the subframe. A UE-specific search space applies for the User set to "User 1..4".

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:SESPace on page 480

**Content Config ← DCI Table**
Opens a dialog to configure the DCI fields of the selected DCI Format.

Remote command:
n.a.

**PDCCH Format (Variable) ← DCI Table**
Sets the PDCCH format.

The PDCCH format determines how many CCEs (control channel elements) will be used for the transmission of the PDCCH.

The table below gives an overview of the supported PDCCH Formats, as defined in the 3GPP specification.

| PDCCH format | Number of CCEs | Number of REGs | Number of PDCCH bits |
|---|---|---|---|
| 0 | 1 | 9 | 72 |
| 1 | 2 | 18 | 144 |
| 2 | 4 | 36 | 288 |
| 3 | 8 | 72 | 576 |

"0" One PDCCH is transmitted on one CCE, i.e. #REG=1.

"1" One PDCCH is transmitted on two CCEs, i.e. #REG=18.

"2" One PDCCH is transmitted on four CCEs, i.e. #REG=36.

"3" One PDCCH is transmitted on eight CCEs, i.e. #REG=72.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:PFMT on page 478

**Number CCEs ← DCI Table**
Defines the number of control channel elements used for the transmission of the PDCCH.

The value is determined by the selected PDCCH Format (Variable).

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:NCCes on page 478

**CCE Index ← DCI Table**
Sets the CCE start index.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:CINDex` on page 479

**Number of Dummy CCEs ← DCI Table**
Defines the number of dummy CCEs that are appended to the corresponding PDCCH.

**Note:** If "Activate Carrier Aggregation > ON", the "Number of Dummy CCEs" is calculated per component carrier and depends on the selected Bandwidth.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:NDCCes` on page 479

**Conflict (DCI) ← DCI Table**
Indicates a conflict between two DCI formats.

For more information on how to solve DCI conflicts, see chapter 5.1.3, "DCI Conflict Handling", on page 53.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:CONFlict?` on page 480

## 7.11.11 DCI Format Configuration

**Carrier Indicator Field (CIF)**
(Requires option R&S SMW-K85 LTE-A Rel. 10)

This field is enabled if the "Activate Carrier Aggregation > ON" and for User with enabled "Configure User > Activate CA".

The CIF is present in **each** DCI Format and indentifies the component carrier that carries the PDSCH or PUSCH for the particuliar PDCCH in the cross-carrier approach (see figure 3-25).

According to the LTE specification, cross-carrier scheduling is enabled by higher-level signaling. To enable cross-carrier scheduling in this implementation, enable the "DL Carrier Aggregation Configuration>CIF Present" for component carrier/cell.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:CIField` on page 481

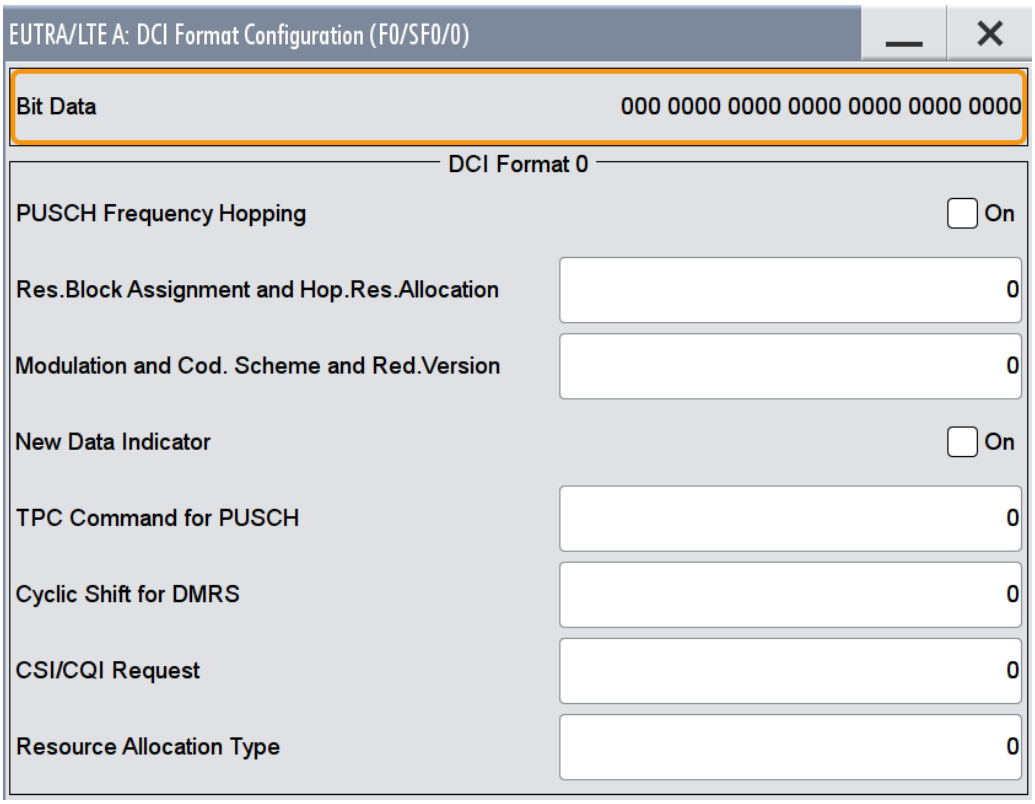
**Bit Data**
Displays the resulting bit data as selected with the DCI format parameters.

The mapping DCI format fields to the information bits is according to the 3GPP specification TS 36.212.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:BITData?` on page 481

**DCI Format 0**

The DCI format 0 is used for scheduling uplink transmission on PUSCH and transmits the information listed in the table bellow.



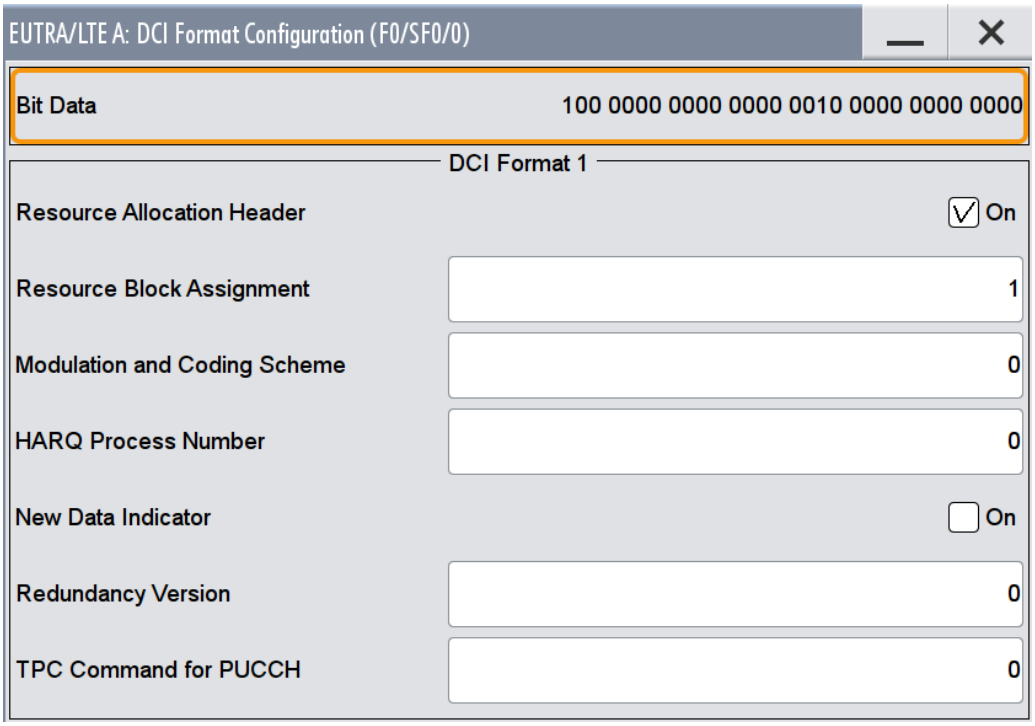

The fields defined in the DCI format are mapped to the information bits according to the 3GPP specification and the resulting Bit Data is displayed.

| Control Information Field | SCPI command | Dependencies |
|---|---|---|
| "Carrier Indicator Field (CIF)" | `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:CIField` on page 481 | see "Carrier Indicator Field (CIF)" on page 176 |
| "PUSCH Frequency Hopping" | `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:PFHopping` on page 486 | |
| "Resource Block Assignment and Hopping Resource Allocation" | `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RAHR` on page 488 | |

| Control Information Field | SCPI command | Dependencies |
|---|---|---|
| "Modulation and Coding Scheme and Redundancy Version" | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:MCSR on page 485 | |
| "New Data Indicator" | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:NDI on page 486 | |
| "TPC Command for PUSCH" | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TPCC on page 491 | |
| "Cyclic Shift for DMRS" | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:CSDMrs on page 483 | |
| "UL Index" | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:ULINdex on page 493 | Enabled for TDD mode and TDD Frame Structure Settings 0 |
| "Downlink Assignment Index" | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:DLAindex on page 484 | Enabled for TDD mode and UL/DL Configuration 1 - 6 |
| "CSI/CQI Request" | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:CSIRequest on page 483 | |
| "Resource Allocation Type" | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RAType on page 488 | |

**DCI Format 1**

The DCI format 1 carries information for scheduling transmission of one code word on PDSCH. The different fields of this format are summarized in the table bellow.

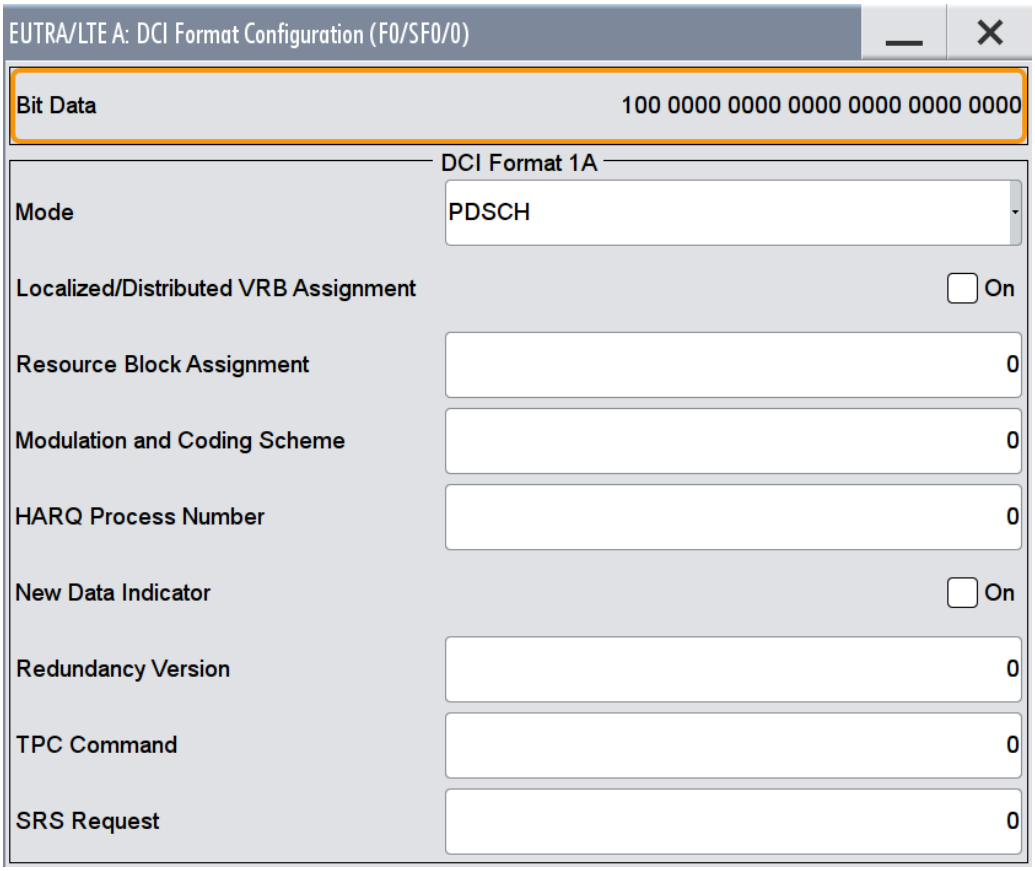



The fields defined in the DCI format are mapped to the information bits according to the 3GPP specification and the resulting Bit Data is displayed.

| Control Information Field | SCPI command | Dependencies |
|---|---|---|
| "Carrier Indicator Field (CIF)" | `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:CIField` on page 481 | see "Carrier Indicator Field (CIF)" on page 176 |
| "Resource Allocation Header" | `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RAH` on page 487 | Enabled for Channel Bandwidth > 10RBs |
| "Resource Block Assignment" | `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RBA` on page 488 | |
| "Modulation and Coding Scheme" | `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:MCSR` on page 485 | |
| "HARQ Process Number" | `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:HPN` on page 485 | |
| "New Data Indicator" | `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:NDI` on page 486 | |
| "Redundancy Version" | `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RV` on page 489 | |
| "TPC Command for PUCCH" | `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TPCC` on page 491 | |
| "Downlink Assignment Index" | `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:DLAindex` on page 484 | Enabled for "TDD" mode |

### DCI Format 1A

DCI format 1A is used for the compact scheduling of one PDSCH code word and random access procedure initiated by a PDCCH order.




The fields defined in the DCI format are mapped to the information bits according to the 3GPP specification and the resulting Bit Data is displayed.

The contents of DCI Format 1A are listed in the table bellow; the available fields depend whether a PDSCH or PRACH is transmitted.

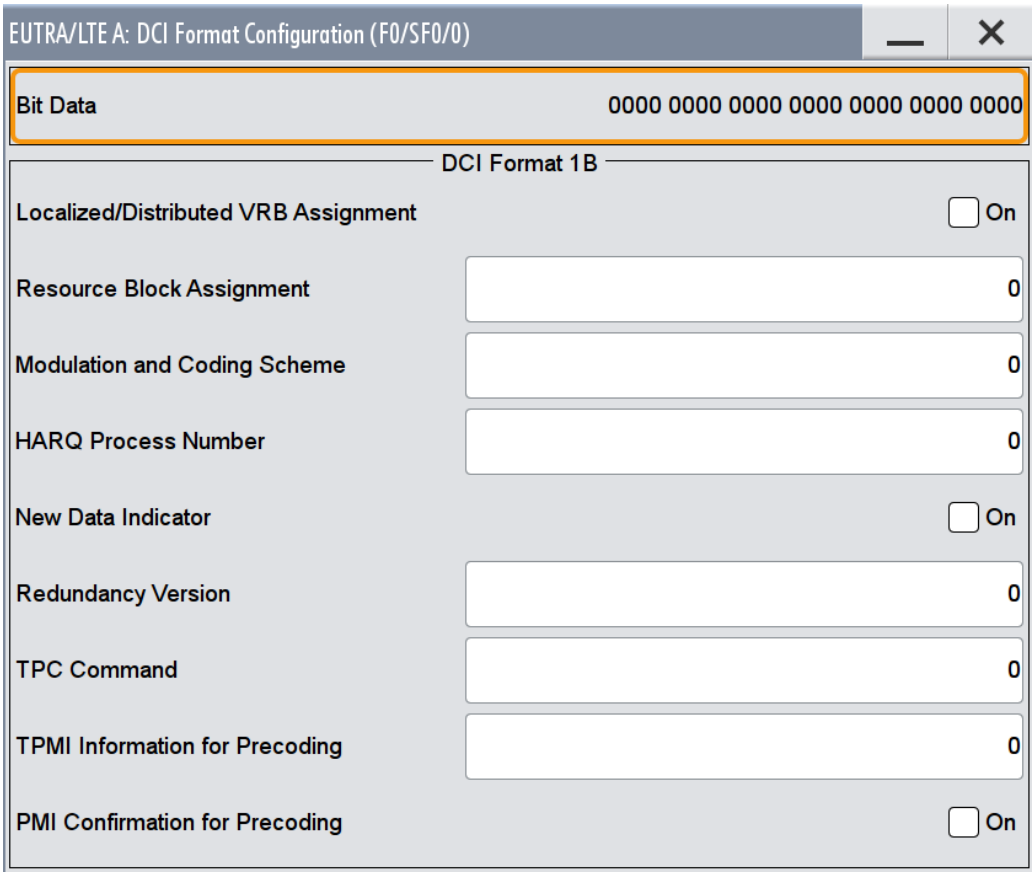
| Control Information Field | SCPI command | Dependencies |
|---|---|---|
| "Carrier Indicator Field (CIF)" | `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:CIField` on page 481 | see "Carrier Indicator Field (CIF)" on page 176 |
| "Mode" | `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:F1AMode` on page 481 | |
| "Localized/Distributed VRB Assignment" | `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:VRBA` on page 493 | |

| Control Information Field | SCPI command | Dependencies |
|---|---|---|
| "GAP Value" | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:GAP on page 484 | Enabled for Channel Bandwidth >= 50RBs, Distributed VBR Assignment and User = User 1..4 |
| "Resource Block Assignment" | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RBA on page 488 | |
| "Modulation and Coding Scheme" | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:MCSR on page 485 | PDSCH Mode |
| "HARQ Process Number" | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:HPN on page 485 | PDSCH Mode |
| "New Data Indicator" | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:NDI on page 486 | PDSCH Mode |
| "Redundancy Version" | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RV on page 489 | PDSCH Mode |
| "TPC Command" | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TPCC on page 491 | PDSCH Mode |
| "Downlink Assignment Index" | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:DLAindex on page 484 | PDSCH Mode Enabled for "TDD" mode |
| "Preamble Index" | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:PRACh:PRINdex on page 482 | PRACH Mode |
| "PRACH Mask Index" | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:PRACh:MINDex on page 482 | PRACH Mode |

**DCI Format 1B**

DCI format 1B is used for the compact scheduling of one PDSCH code word with precoding information, i.e. when MIMO operation is involved.

The precoding information consists of 2 or 4 bits for 2 and 4 antennas respectively.




The fields defined in the DCI format are mapped to the information bits according to the 3GPP specification and the resulting Bit Data is displayed.

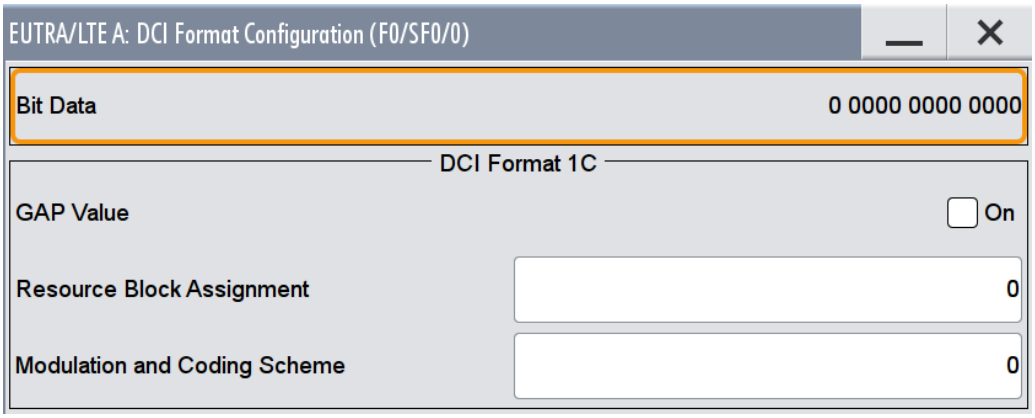
The DCI Format 1B transmits the information listed in the table bellow.

| Control Information Field | SCPI command | Dependencies |
|---|---|---|
| "Carrier Indicator Field (CIF)" | `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:CIField` on page 481 | see "Carrier Indicator Field (CIF)" on page 176 |
| "Localized/Distributed VRB Assignment" | `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:VRBA` on page 493 | |
| "GAP Value" | `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:GAP` on page 484 | Enabled for Channel Bandwidth >= 50RBs, Distributed VBR Assignment and User = User 1..4 |
| "Resource Block Assignment" | `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RBA` on page 488 | |
| "Modulation and Coding Scheme" | `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:MCSR` on page 485 | |

| Control Information Field | SCPI command | Dependencies |
|---|---|---|
| "HARQ Process Number" | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:HPN on page 485 | |
| "New Data Indicator" | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:NDI on page 486 | |
| "Redundancy Version" | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RV on page 489 | |
| "TPC Command" | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TPCC on page 491 | |
| "Downlink Assignment Index" | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:DLAindex on page 484 | Enabled for TDD mode |
| "TPMI Information for Precoding" | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TPMI on page 492 | |
| "PMI Confirmation for Precoding" | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:PMI on page 486 | |

### DCI Format 1C

DCI format 1C is used for very compact scheduling of one PDSCH code word.



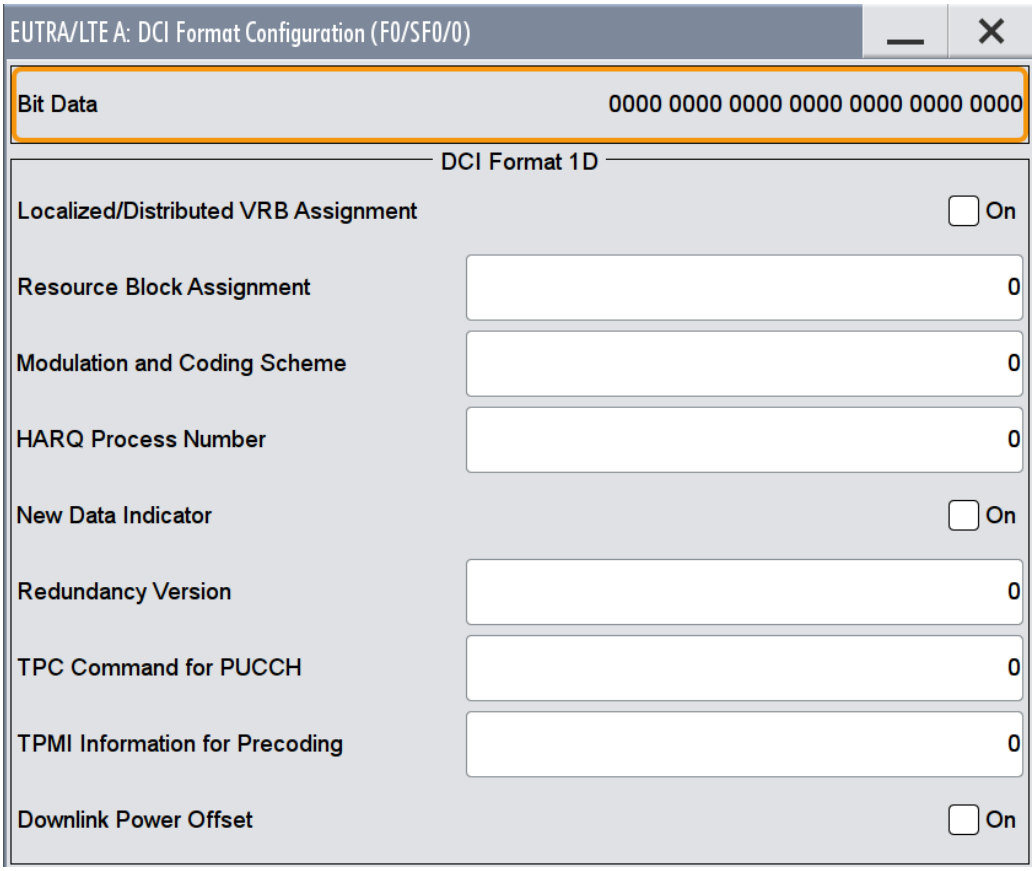

The fields defined in the DCI format are mapped to the information bits according to the 3GPP specification and the resulting Bit Data is displayed.

The DCI Format 1C transmits the information listed in the table bellow.

| Control Information Field | SCPI command | Dependencies |
|---|---|---|
| GAP Value | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:GAP on page 484 | Enabled for Channel Bandwidth >= 50RBs |
| Resource Block Assignment | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RBA on page 488 | |
| Modulation and Coding Scheme | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:MCSR on page 485 | |

### DCI Format 1D

DCI format 1D is used for the compact scheduling of one PDSCH code word with precoding and power offset information.




The fields defined in the DCI format are mapped to the information bits according to the 3GPP specification and the resulting Bit Data is displayed.

The DCI Format 1D transmits the information listed in the table bellow.

| Control Information Field | SCPI command | Dependencies |
|---|---|---|
| "Carrier Indicator Field (CIF)" | `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:CIField` on page 481 | see "Carrier Indicator Field (CIF)" on page 176 |
| Localized/Distrib | `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:VRBA` on page 493 | |
| Resource Block Assignment | `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RBA` on page 488 | |
| GAP Value | `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:GAP` on page 484 | Enabled for Channel Bandwidth >= 50RBs, Distributed VBR Assignment and User = User 1..4 |

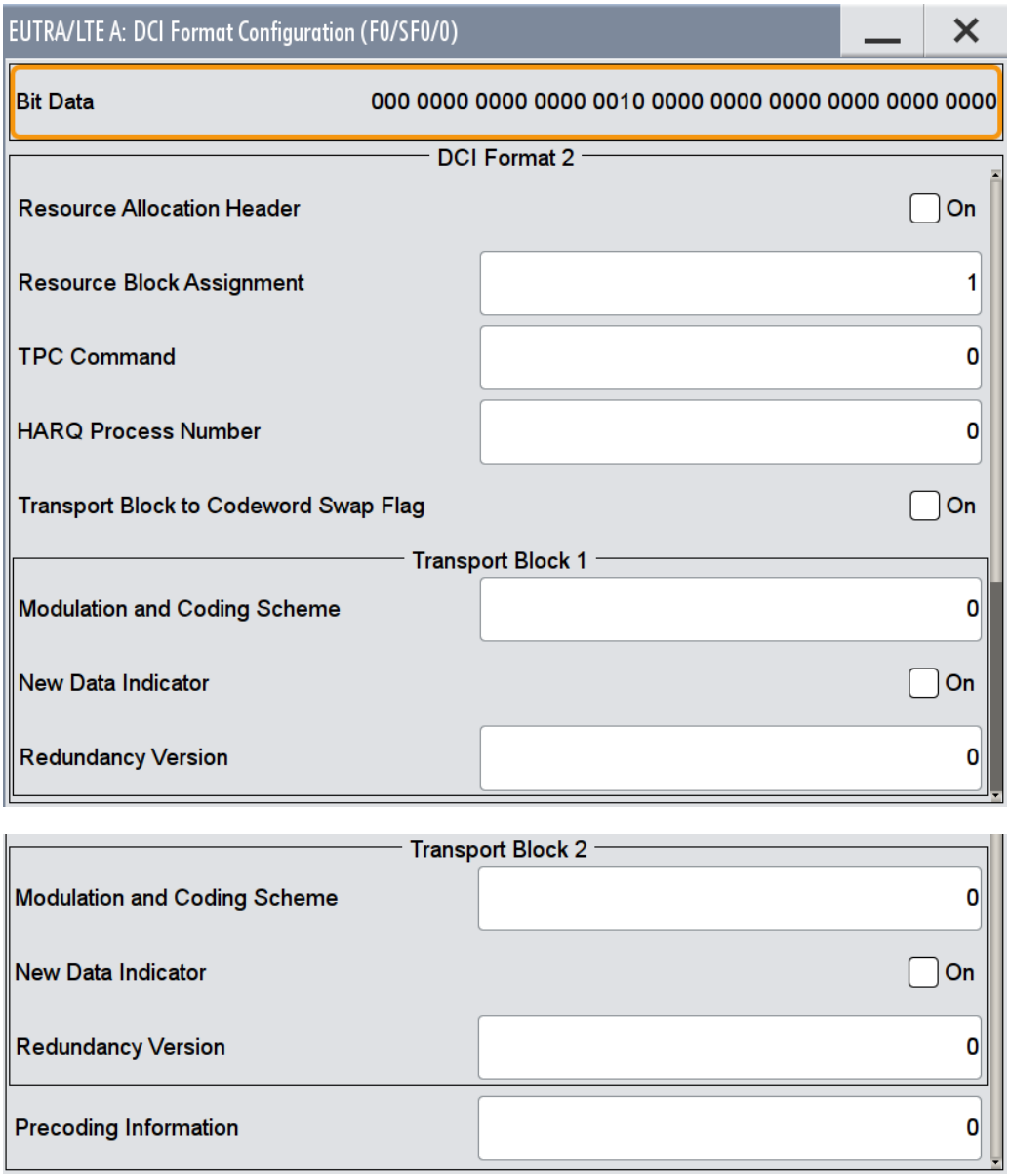
| Control Information Field | SCPI command | Dependencies |
|---|---|---|
| Modulation and Coding Scheme | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:MCSR on page 485 | |
| HARQ Process Number | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:HPN on page 485 | |
| New Data Indicator | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:NDI on page 486 | |
| Redundancy Version | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RV on page 489 | |
| TPC Command for PUCCH | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TPCC on page 491 | |
| Downlink Assignment Index | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:DLAindex on page 484 | Enabled for TDD mode |
| TPMI Information for Precoding | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TPMI on page 492 | |
| Downlink Power Offset | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:DPOFfset on page 484 | |

**DCI Format 2/2A/2B**

The DCI Format 2 is used for scheduling PDSCH when spatial multiplexing is configured. The DCI Format 2A is also used for the scheduling in a spatial multiplexing configuration, but without PMI feedback. The DCI Format 2B is enabled for 2-, 4-Tx-Antennas.

Since MIMO operation requires two codewords, the modulation and coding scheme, new data indicator and the redundancy version are signaled separately for each of the codewords. The spatial multiplexing also requires a transmission of precoding information.

The transport block to codeword mapping is performed according to the 3GPP specification, i.e. transport block 1 (TB1) is mapped to codeword 1 (CW1) and TB2 to CW2 respectively. The "Transport Block to Codeword Swap Flag "determines the mapping in case both transport blocks are enabled. If this swap flag is enabled, the TB1 is mapped to CW2 and vice versa.




The fields defined in the DCI format are mapped to the information bits according to the 3GPP specification and the resulting Bit Data is displayed.

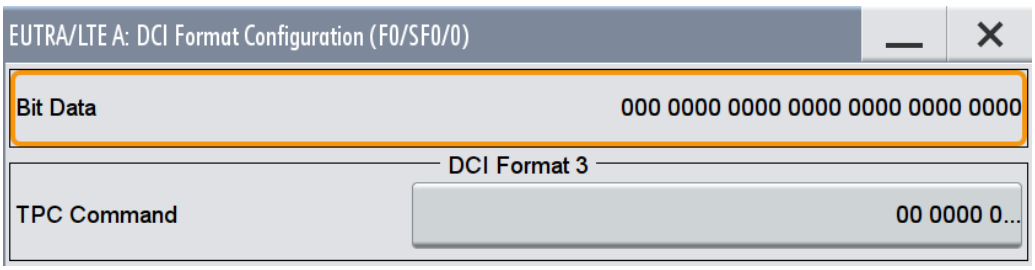
The DCI Format 2/2A/2B transmits the information listed in the table bellow.

| Control Information Field | SCPI command | Dependencies |
|---|---|---|
| "Carrier Indicator Field (CIF)" | `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:CIField` on page 481 | see "Carrier Indicator Field (CIF)" on page 176 |
| Resource Allocation Header | `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RAH` on page 487 | Enabled for Channel Bandwidth > 10RBs |
| Resource Block Assignment | `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RBA` on page 488 | |

| Control Information Field | SCPI command | Dependencies |
|---|---|---|
| TPC Command for PUCCH | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TPCC on page 491 | |
| Downlink Assignment Index | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:DLAindex on page 484 | Enabled for TDD mode |
| HARQ Process Number | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:HPN on page 485 | |
| Transport Block to Codeword Swap Flag | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:SWAPflag on page 489 | DCI Format 2/2A only |
| Scrambling Identity | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:SID on page 491 | DCI Format 2B only |
| Precoding Information | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:PRECinfo on page 487 | DCI Format 2/2A only |
| | "Transport Block 1" | |
| Modulation and Coding Scheme | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TB1:MCS on page 490 | |
| New Data Indicator | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TB2:NDI on page 490 | |
| Redundancy Version | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TB1:RV on page 490 | |
| | "Transport Block 2" | |
| Modulation and Coding Scheme | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TB2:MCS on page 490 | |
| New Data Indicator | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TB2:NDI on page 490 | |
| Redundancy Version | [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TB2:RV on page 490 | |

### DCI Format 3/3A

The DCI Format 3/3A is used for the transmission of TPC Commands for PUCCH and PUSCH with 2-bit and a single bit power adjustment respectively.




The "TPC Command" is set as a bit pattern.

The field defined in the DCI format are mapped to the information bits according to the 3GPP specification and the resulting Bit Data is displayed.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TPCinstr` on page 492

## 7.12 Enhanced PBCH, PDSCH and PMCH Settings

1. To access this dialog, select "General > Link Direction > Downlink (OFDMA)".
2. Select "Frame Configuration > Subframe > Content Type".
3. Select one of the following "Content Type"
   a) "PBCH"
   b) "PDSCH"
   c) "PMCH"
4. Select "Enhanced Settings > Config..."

   This dialog allows you to define and configure the precoding and the channel coding settings for the DL channels PBCH and PDSCH. The settings are configurable on a subframe basis.

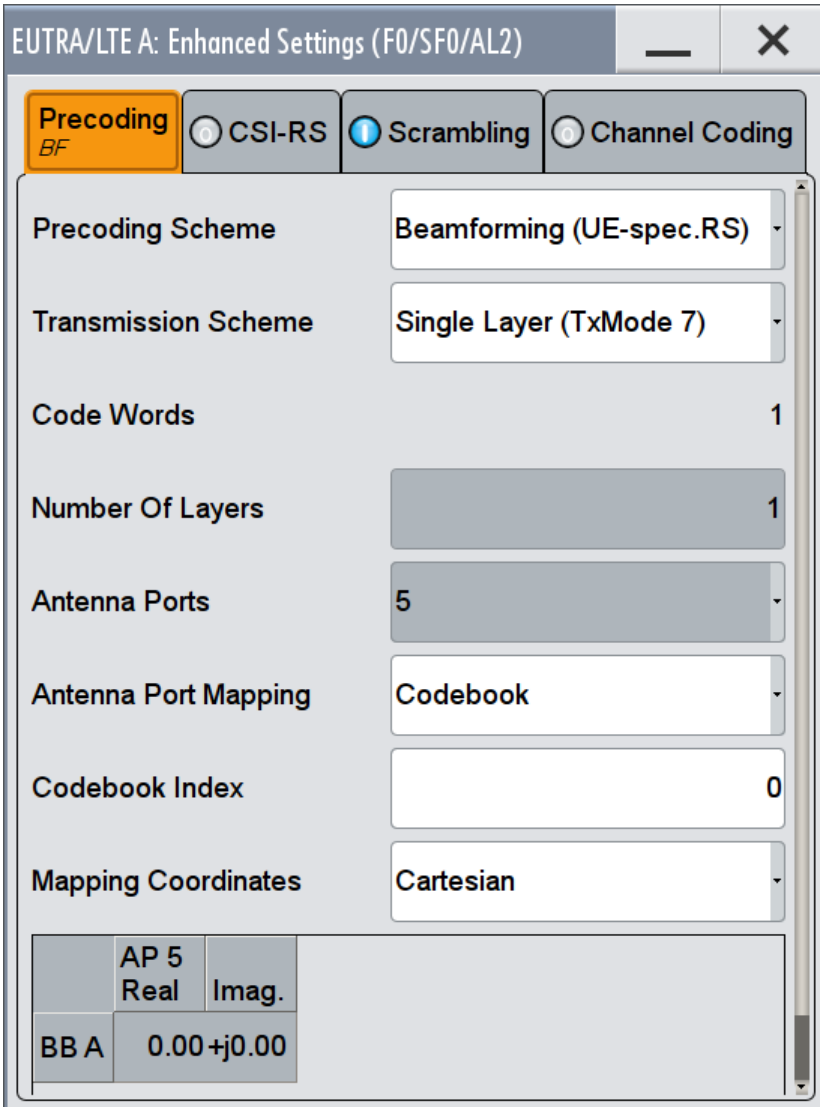
The parameters available for configuration in section "Precoding" depend on the global MIMO configuration, the content of the allocation and the selected codeword. Because the same precoding settings are used for both codewords, the "Precoding" section is not displayed in the "Enhanced Settings" dialog of the second codeword.

The values of parameters "Scrambling State", "UE ID" and "Channel Coding State" are read-only for all allocations, where a User 1..4 is selected as "Data Source". These parameters are set in the User Configuration Settings dialog for the corresponding user.

For all allocations belonging to the same user, the "Enhanced Settings" dialog is accessed from any allocation related to this user.

### 7.12.1 Precoding Settings

► To access this dialog, select "Precoding".




The parameters available for configuration in this dialog depend on the global MIMO configuration, the content of the allocation and the selected codeword. Because the same precoding settings are used for both codewords, the "Precoding" section is not displayed in the "Enhanced Settings" dialog of the second codeword.

**Precoding Scheme**
Selects the precoding scheme.

This parameter is available for the first codeword only.

**Note:** The available selections depend on the selected Content Type and the MIMO Configuration.

"None" Disables precoding.

"Spatial Multiplexing"
Precoding for spatial multiplexing will be performed according to 3GPP TS 36.211 [3] and the selected parameters.

"Tx Diversity" Precoding for transmit diversity will be performed according to 3GPP TS 36.211 [3] and the selected parameters.

"Beamforming (UE-spec.RS)"
Sets the PDSCH to transmission mode selected with the parameter Transmission Scheme.

"Antenna Port 4"
(for instruments equipped with R&S SMW-K84)
Default precoding scheme for the PMCH transmitted in MBFSN subframes.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:SCHeme` on page 460

**Transmission Scheme**
(for instruments equipped with R&S SMW-K84)

Determines the transmission scheme (see also table 3-3).

| "Transmission Scheme" | Available for Global MIMO Configuration | Description |
|---|---|---|
| "Single Layer (TxMode 7)" | SISO+BF<br>2Tx/4Tx-Antennas | Sets the PDSCH to transmission mode 7, as described in 3GPP TS 36.213, i.e. UE-specific RS (DM-RS) will be added to the PDSCH.<br>This special mode is defined for transmission using antenna port 5.<br>**Tip:** To enable the instrument to generate a **transmission using antenna port 5** signal (transmission corresponding to the UE-specific reference signal) as defined in the 3GPP TS 36.101, chapter 8.3, select "Global MIMO Configuration > SISO + BF". |
| "Dual layer (TxMode 8)" | SISO+BF<br>2Tx/4Tx-Antennas | Sets the PDSCH to transmission mode 8, as described in 3GPP TS 36.213, i.e. UE-specific RS will be added to the PDSCH.<br>In this mode antenna ports 7 and 8 are used.<br>By default, the antenna ports 7 and 8 are mapped on the the first two Basebands but this configuration can be changed.<br>**Tip:** To enable the instrument to generate a transmission using antenna port 7 and 8, set the parameter "Global MIMO Configuration" to "SISO + BF", "2 Tx-antennas" or "4 Tx-antennas". |

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:TRSCheme` on page 461

**Code Word**
Displays the number of the codeword and the total number of codewords used for the selected allocation.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>:CODWords`
on page 429

**Number of Layers**
Displays the number of layers for the selected allocation. The number of available layers depends on the selected "Content Type" and the "Precoding Scheme".

The combination of number of code words and number of layers determines the layer mapping for the selected precoding scheme.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:NOLayers` on page 459

**Scrambling Identity n_SCID**
Sets the scrambling identity according to 36.211, sec. 6.10.3.1.

This value is used for initialization of the sequence used for generation of the UE-specific reference signals.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:SCID` on page 460

**Antenna Ports**
(for instruments equipped with R&S SMW-K84)

Displays and configures the antenna port(s) for the selected Transmission Scheme.

In case only one code word and therefore only one layer is configured in the "Dual Layer (TxMode 8)", the mapping of the layer to antenna port 7 or antenna port 8 is configurable.

**Tip:** Use this configuration possibility to configure a dual-layer multi-user MIMO (MU-MIMO) scenario.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:AP` on page 457

**Antenna Port Mapping**
(for instruments equipped with R&S SMW-K84)

Sets the way that the logical antenna ports are mapped to the physical Tx antennas, see chapter 7.13, "Antenna Port Mapping Settings", on page 197.

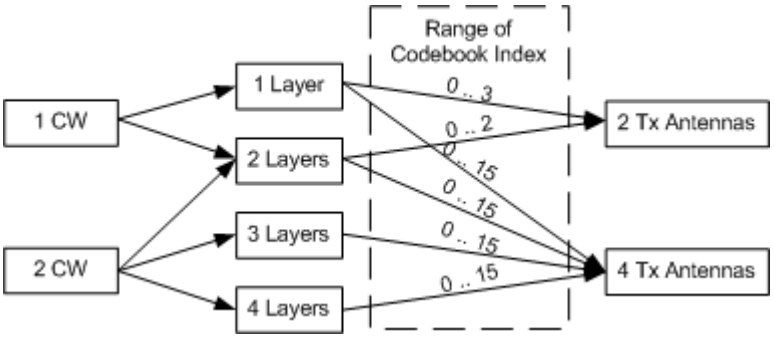
Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:APM` on page 458

**Codebook Index**
(Enabled for Precoding Scheme set to Tx Diversity or Spatial Multiplexing and codeword 1 only)

Sets the codebook index for the selected allocation, i.e. selects the predefined pre-coder matrix.

The number of available codebook indices depends on the Global MIMO Configuration, i.e. the number of used antennas.

The figure bellow shows the range of the Codebook Index for Spatial Multiplexing.




The combination of codebook index and the selected Number of Layers determines the pre-coding matrix used for precoding.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:CBINdex` on page 458

**Cyclic Delay Diversity**
(Enabled for Precoding Scheme set to Tx Diversity or Spatial Multiplexing and codeword 1 only)

Sets the CDD for the selected allocation.

The combination of cyclic delay diversity and the selected Number of Layers determines the precoding parameters for spatial multiplexing.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:CDD` on page 458

**Mapping Coordinates**
Switches between the Cartesian (Real/Imag.) and Cylindrical (Magn./Phase) coordinates representation.

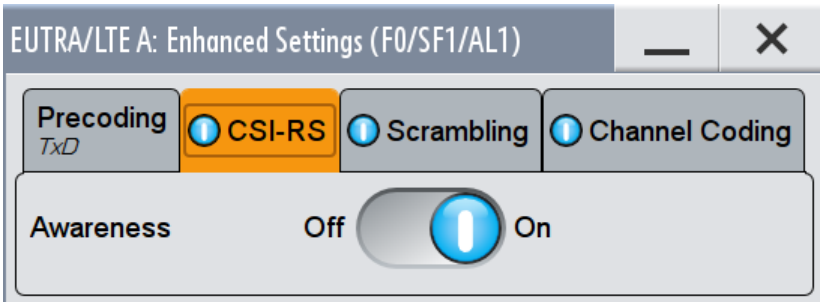
Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:DAFormat` on page 459

**Mapping Table**
(for instruments equipped with R&S SMW-K84)

Defines the mapping of the antenna ports (AP) to the physical antennas, see chapter 7.13, "Antenna Port Mapping Settings", on page 197.

### 7.12.2 CSI-RS Settings

► To access this dialog, select "DL Allocation Table > Ench. Settings > CSI-RS".




In this dialog the CSI Awareness can be enabled/disabled.

**CSI Awareness**
Determines the way the PDSCH is processed.

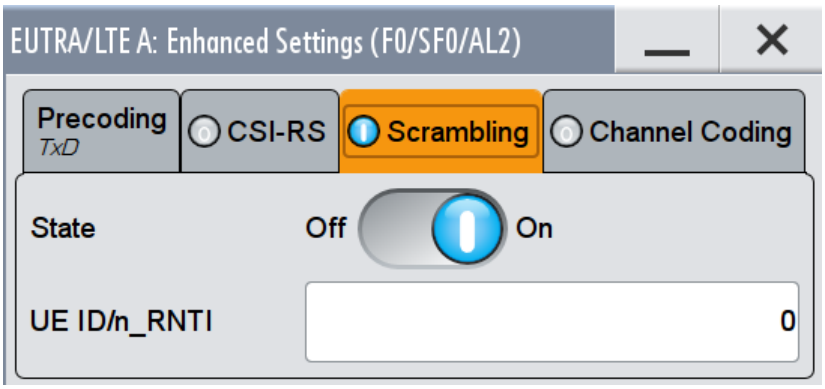
"On" During the channel coding, the resource elements configured for the CSI-RS transmission are explicitly avoided and the PDSCH is mapped only on the available physical bits.

"Off" The channel coding is performed as if the CSI-RS will not be transmitted, i.e. the PDSCH mapping is not modified to avoid the resource elements on that the CSI-RS can be transmitted.
This process leads to increased bit rate, but an UE receiving this PDSCH will still decode the information correctly.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>:CAW` on page 455

### 7.12.3 Scrambling Settings

► To access this dialog, select "Scrambling".




This dialog comprises the settings needed for configuring the scrambling.

Provided are the following settings:

**State Scrambling (DL)**
Enables/disables the bit-level scrambling.

If a "User 1..4" is selected for the Data Source in the allocation table for the corresponding allocation, the "State Scrambling" is read only and the value is displayed as set in the User Configuration Settings dialog for the corresponding user.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SCRambling:STATe` on page 461

**UE ID/n_RNTI (PDSCH)**
Sets the user equipment identifier (n_RNTI) of the user to which the PDSCH transmission is intended. The UE ID is used to calculate the scrambling sequence.

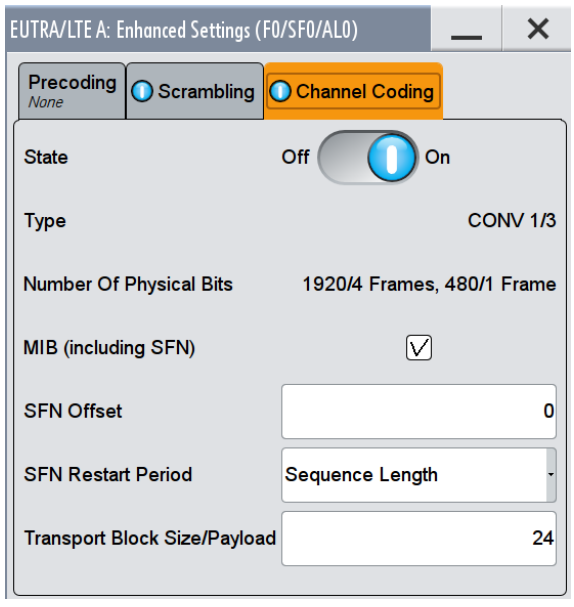
If a "User 1..4" is selected for the Data Source in the allocation table for the corresponding allocation, the "UE ID" is read only and the value is displayed as set in the User Configuration Settings dialog for the corresponding user.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SCRambling:UEID` on page 461

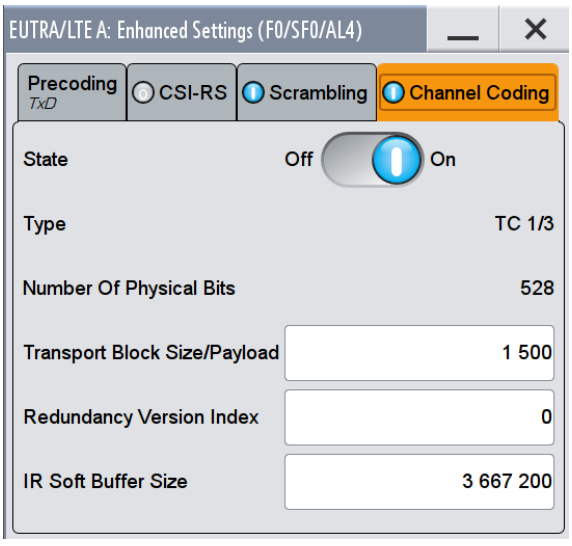
## 7.12.4 Channel Coding Settings

► To access this dialog, select "Channel Coding".

"Channel Coding " settings for "PBCH".




"Channel Coding " settings for "PDSCH".



This dialog comprises the settings needed for configuring the channel coding. The settings vary according to the selected "Content Type"

Provided are the following settings:

**State Channel Coding (DL)**
Enables/disables channel coding for the selected allocation and code word.

If a User "1..4" is selected for the Data Source in the allocation table for the corresponding allocation, the "Channel Coding State" is read only and the value is displayed as set in the User Configuration Settings dialog for the corresponding user.

A PBCH can be generated in one of the following modes:
- Without channel coding, i.e. this parameter is disabled.
  Dummy data or user-defined data list are used.
- Channel coding with arbitrary transport block content
  Channel coding is activated and parameter MIB (including SFN) is disabled.
- Channel coding with real data (MIB) including SFN
  Channel coding and MIB are activated.

For the PBCH allocation with activated channel coding, one block of data (Transport Block Size of 24) is coded jointly and then spread over four frames. Hence, the ARB sequence length has to be set accordingly to be a multiple of four.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:STATe` on page 456

**Type Channel Coding (DL)**
Displays the used channel coding scheme and channel coding rate.

PBCH uses always tail biting convolution coding with code rate 1/3; PDSCH uses always turbo code with code rate 1/3.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:TYPE?` on page 457

**Number of Physical Bits (DL)**
Displays the size of the selected allocation in bits and considering the subcarriers that are used for other signals or channels with higher priority (see chapter 5.1, "Conflict Handling in the R&S Signal Generator", on page 51).

If a User 1...4 is selected for the Data Source in the allocation table for the corresponding allocation, the value of the parameter "Number of Physical Bits" is the sum of the "Physical Bits" of all single allocations that belong to the same user in the selected subframe.

The size of the PBCH allocation is fixed to 1920/4 Frames, 480/1 Frame.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PHYSbits?` on page 433
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:USER<ch>:PHYSbits?`
on page 437

**MIB (including SFN)**
(for PBCH only)

Enables/disables transmission of real MIB (master information block) data, calculated according to the values of the following "General DI Settings" parameters:

- Channel Bandwidth
- PHICH Duration
- "PHICH N_g" on page 134

The SFN (System Frame Number) is included as well.

If this parameter is enabled, the "Transport Block Size" is fixed to 24 and the Data Source for the PBCH allocation is set to "MIB".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:PBCH:MIB` on page 454

**SFN Offset**
(for PBCH only)

By default, the counting of the SFN (System Frame Number) starts with 0. Use this parameter to set a different start SFN value.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:PBCH:SOFFset` on page 454

**SFN Restart Period**
(for instruments equipped with R&S SMW-K84)

not available for R&S SMBV and R&S WinIQSIM2

Determines the time span after which the SFN (System Frame Number) restarts.

By default, the SFN restart period is equal to the ARB sequence length. Selecting a SFN restart period of "1024 Frames", enables the instrument to calculate the PBCH including SFN independently from the other channels. With this setting, the SFN restarts after 1024 frames and the generation process is fully 3GPP compliant, but the calculation may take very long time.

**Tip:** Use the "3GPP (1024 Frames)" mode only if 3GPP compliant SFN period is required!

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:PBCH:SRPeriod` on page 455

**Transport Block Size/Payload (DL)**
Defines the size of the transport block/payload in bits.

- Since only one transport block is generated and spread over all allocations, for allocations with "Data Source" set to User 1..4, the channel coding parameters "Transport Block Size", "Redundancy Version Index" and "IR Soft Buffer Size" are related to all allocations that belong to the same user in the corresponding subframe.
- In case a spatial multiplexing with two code words is configured, individual transport blocks for the two code blocks are generated.
- For PBCH allocations with enabled parameter MIB (including SFN), the transport block size is fixed to 24.

Set the transport block size to 24 if a generation compliant to the 3GPP specifications is required.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:TBSize` on page 456

**Redundancy Version Index (PDSCH)**
Sets the redundancy version index.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:RVINdex` on page 456

**IR Soft Buffer Size (PDSCH)**
Sets the size of the IR soft buffer for the selected transport block (N_IR from TS 36.212).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:ISBSize` on page 455

## 7.13 Antenna Port Mapping Settings

The 3GPP standard defines the different antenna ports for transmission in different transmission modes (TM, also "TxMode") and for the transmission of different reference signals, see table 3-3 and chapter 3.2.5, "Downlink Reference Signal Structure and Cell Search", on page 23.

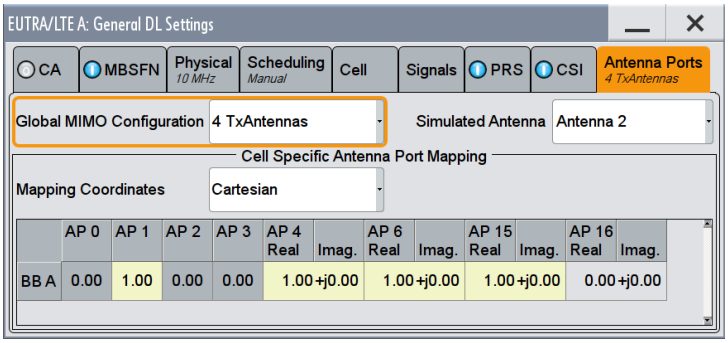
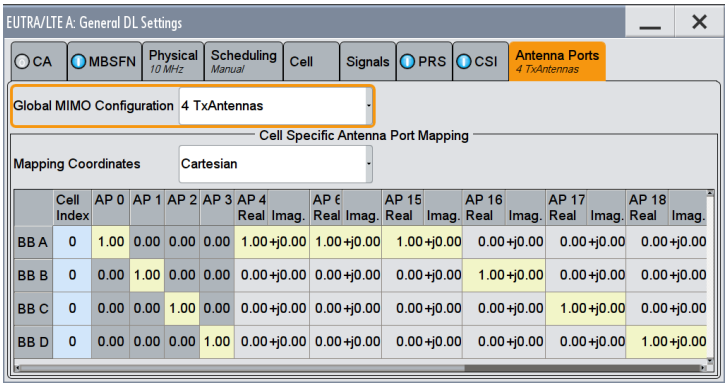
The settings necessary to configure the reference signals and to enable the transmission modes are not grouped into one particular dialog but distributed among the corresponding dialogs, depending on their type (cell-specific, user specific, etc.). The related antenna port mapping settings are distributed in these dialogs, too.

**To access the antenna port mapping settings:**

1. Select "General > Link Direction > Downlink (OFDMA)".
2. Perform the following:

a) For configuration of the cell-specific anntena port mapping, select "General DL Settings > Antenna Ports".
The provided settings depends on the selected "System Configuration > Fading and Baseband Configuration > Mode" and the enabled LxMxN MIMO scenario, i.e. the number of enabled "Entities", "Basebands" and "Streams".
For more information on this topic, refer to the user manual of the base unit.
See table 7-11 and compare the displayed settings for the same 4x4 MIMO configuration.

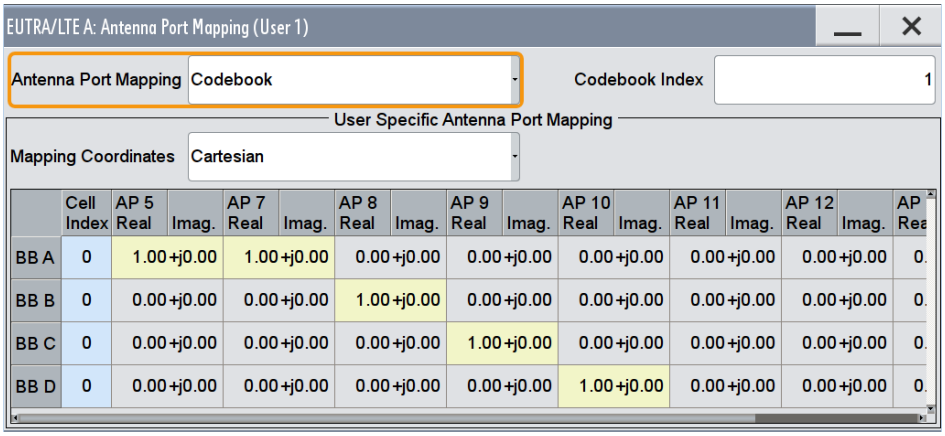
***Table 7-11: Antenna ports settings depending on the ebabled MxN MIMO configuration and "System Configuration" mode***

| **"System Configuration > Fading/Baseband Configuration > Mode"** | **"System Configuration > Fading/Baseband Configuration > 1x4x4"** |
|---|---|
| "Standard" |  |
| "Advanced" |  |



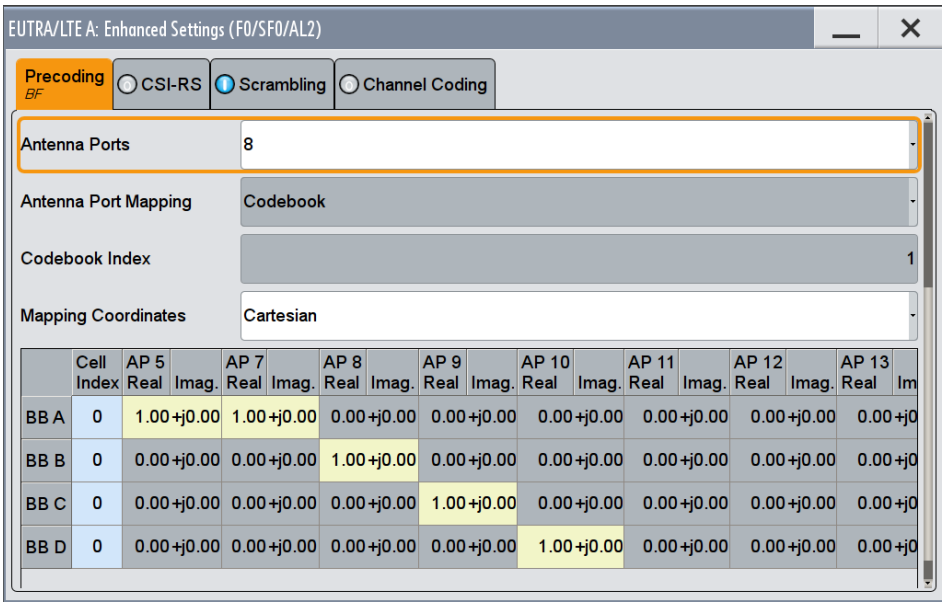
EUTRA/LTE A: General DL Settings
CA
MBSFN
Physical 10 MHz
Scheduling Manual
Cell
Signals
PRS
CSI
Antenna Ports 4 TxAntennas
Global MIMO Configuration
4 TxAntennas
Cell Specific Antenna Port Mapping
Mapping Coordinates
Cartesian
Cell Index AP 0 AP 1 AP 2 AP 3 AP 4 Real Imag. AP 15 Real Imag. AP 16 Real Imag. AP 17 Real Imag. AP 18 Real Imag.
BB A 0 1.00 0.00 0.00 0.00 1.00+j0.00 1.00+j0.00 0.00+j0.00
BB B 0 0.00 1.00 0.00 0.00 0.00+j0.00 0.00+j0.00 1.00+j0.00 0.00+j0.00 0.00+j0.00
BB C 0 0.00 0.00 1.00 0.00 0.00+j0.00 0.00+j0.00 0.00+j0.00 0.00+j0.00 1.00+j0.00 0.00+j0.00
BB D 0 0.00 0.00 0.00 1.00 0.00+j0.00 0.00+j0.00 0.00+j0.00 0.00+j0.00 0.00+j0.00 1.00+j0.00

b) For configuration of the user specific anntena port mapping, select "Frame Configuration > General > User Configuration > Antenna Mapping > Config".




c) For configuration of the PDSCH belonging to a particular user, for example an UE1:

- select "Frame Configuration > Subframe > Subframe Selection#0 > No. of Used Allocation = 3"
- select "Frame Configuration > Subframe > Allocation Table > All#2 > Data Source > UE1"
- select "Frame Configuration > Subframe > Allocation Table > All#2 > Enh. PDSCH Settings > Precoding"
- select "Precoding > Beamforming (UE-spec. RS)" and define the "Transmission Scheme"




These dialogs comprise the settings necessary to configure the mapping of the logical antenna ports to the physical Tx antennas (enabled Basebands). The number of physical antennas is set with the parameter "General DL Settings > Global MIMO Configuration".

The dialogs consist of two parts, a mapping table and a selection about the way the antenna mapping is performed.
The yellow matrix elements indicate the default antenna port to physical antenna (Tx antenna/baseband) mapping.

**Mapping Methods**

The antenna mapping can be performed according to one of the following three methods:

- "Codebook"
  The used precoding weights are according to the 3GPP TS 36.211 [3], table 6.3.4.2.3-1 resp. 6.3.4.2.3-2. The selected element is defined by the selected codebook index and the number of layers.
- "Random codebook"
  The precoding weights are selected randomly from the tables defined for the codebook method.
- "Fixed weight"
  A fixed precoding weight can be defined which will be used for all allocations of the according “User” throughout the frame.

Depending on the selected mapping method, the mapping table is invisible ("Random codebook"), read-only ("Codebook") or full configurable ("Fixed weight").

**Mapping Table**

The mapping table is a matrix with number of rows equal to the number of physical Tx antennas (Basebands) and number of columns equal of the number of antenna ports (AP). The available antenna ports depend on the current configuration (see also table 4-2).

- Antenna Ports AP0, AP1, AP2 and AP3 are always mapped to the four Tx antennas "BB A", "BB B", "BB C" and "BB D".
- Antenna Port AP4 is reserved for the MBSFN RS ("General DL Settings > MBSFN > State > Mixed") and per default mapped to "BB A".
- Antenna Port AP5 is reserved for the UE-specific RS (DM-RS) in TM7, AP7/AP8 are reserved for TM8 ("Frame Configuration > General > User Configuration > Antenna Mapping > Config")
- Antenna Port AP6 is reserved for the PRS ("General DL Settings > PRS > State > ON") and per default mapped to "BB A".
- Antenna Ports AP9 - AP14 are used by TM9 ("Frame Configuration > General > User Configuration > Antenna Mapping > Config")
- Antenna Ports AP15 - AP22 are reserved for and depends on the enabled antenna ports for the CSI-RS ("General DL Settings > CSI > State > ON" and "General DL Settings > CSI > Number of CSI-RS Antenna Ports").

**Cell Specific Antenna Port Mapping**
(enabled for instruments eqquiped with R&S SMW-K84)

Comprises the settings for defining the mapping of the logical antenna ports to the available physical Tx antennas (Basebands).

**Mapping Coordinates ← Cell Specific Antenna Port Mapping**
Switches between the Cartesian (Real/Imag.) and Cylindrical (Magn./Phase) coordinates representation.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MIMO:APM:MAPCoordinates` on page 403

**Mapping table ← Cell Specific Antenna Port Mapping**
Defines the mapping of the antenna ports (AP) to the physical antennas.

See "Mapping Table" on page 200.

If carrier aggregation is activated ("EUTRA/LTE > General DL Settings > CA > Activate Carrier Aggregation > On") or "System Configuration > Fading/Baseband Configuration > BB Source Config > Coupled Sources" are used, the colum "Cell Index" indicates the corresponding parameter of the current simulated cell(s).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MIMO:APM:CS:AP<dir0>:BB<st0>:REAL`
on page 402
`[:SOURce<hw>]:BB:EUTRa:DL:MIMO:APM:CS:AP<dir0>:BB<st0>:IMAGinary`
on page 402

**Antenna Port Mapping (User)**
Comprises the settings for defining the mapping of the logical APs to the available physical Tx antennas.

**Antenna Port Mapping ← Antenna Port Mapping (User)**
Defines the antenna port mapping method, see Mapping Methods.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:MODE` on page 510

**Codebook Index ← Antenna Port Mapping (User)**
Sets the codebook index for mapping mode Codebook.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:CBINdex` on page 509

**Mapping Coordinates ← Antenna Port Mapping (User)**
Switches between the Cartesian (Real/Imag.) and Cylindrical (Magn./Phase) coordinates representation.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:MAPCoordinates` on page 509

**Mapping table ← Antenna Port Mapping (User)**
Defines the mapping of the antenna ports (AP) to the physical antennas, see also "Mapping Table" on page 200.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:AP<dir0>:BB<st0>:REAL` on page 509
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:AP<dir0>:BB<st0>:IMAGinary` on page 509

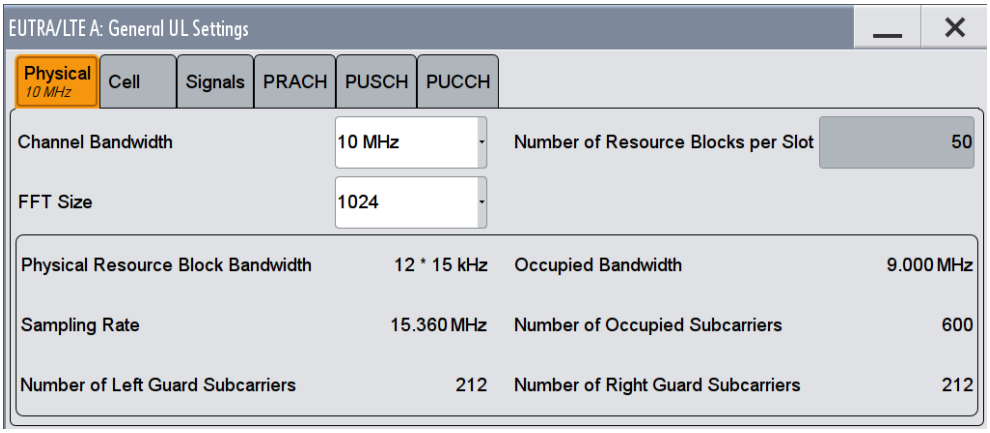
## 7.14 General UL Settings

1. To access this dialog, select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "General UL "

   This dialog allows configuring the EUTRA/LTE system for transmission direction uplink.

### 7.14.1 Physical Settings

1. To access this dialog, select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "General UL > Physical "




This dialog comprises the physical settings for uplink .

Provided are the following settings:

**Channel Bandwidth (UL)**
Sets the channel bandwidth of the EUTRA/LTE system.

Although the 3GPP specification bases on bandwidth agonistic layer 1 and channel bandwidth is determined by specifying the desired number of resource blocks, the current EUTRA standardization focuses on six bandwidths (1.4, 3, 5, 10, 15 and 20 MHz).

For backward compatibility with previous version of the implementation, this parameter allows the flexibility to choose, whether a user defined bandwidth or one of the pre-defined channel bandwidths is used.

If a pre-defined channel bandwidth is selected; the actual "Number of Resource Blocks Per Slot" is internally calculated for the selected "Channel Bandwidth" and "Physical Resource Block Bandwidth".

The sampling rate, occupied bandwidth and FFT size are therefore determined by the parameter "Number of Resource Blocks Per Slot". If required, the FFT Size can be adjusted.

See also table 4-1 for an overview ot this cross-reference between the parameters.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:BW` on page 414

**Physical Resource Block Bandwidth (UL)**
Displays the bandwidth of one physical resource block.

**Note:** In this release, this value is fixed to 12 x 15 kHz.

Remote command:
n.a.

**Number of Resource Blocks Per Slot (UL)**
This parameter determines the channel bandwidth.

If the parameter "Channel Bandwidth" is set to one of the pre-defined channel bandwidths (1.4, 3, 5, 10, 15 or 20 MHz), the value "Number of Resource Blocks Per Slot" is read only and is automatically set according to the selected channel bandwidth and "Physical Resource Block Bandwidth".

If a user defined channel bandwidth is selected, the parameters "Number of Resource Blocks Per Slot" and "Physical Resource Blocks Bandwidth" determine the actual channel bandwidth.

The sampling rate and the occupied bandwidth are determined by the parameter "Number of Resource Blocks Per Slot". If required, the FFT Size can be adjusted.

See also table 4-1 for an overview ot this cross-reference between the parameters.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:NORB` on page 414

**FFT Size (UL)**
Sets the FFT (Fast Fourier Transformation) size. The available values depend on the selected "Number of Resource Blocks Per Slot".

See also table 4-1 for an overview ot this cross-reference between the parameters.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:FFT` on page 415

**Occupied Bandwidth (UL)**
Displays the occupied bandwidth. The value is automatically set according to the parameter "Number of Resource Blocks Per Slot".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:OCCBandwidth?` on page 415

**Sampling Rate (UL)**
Displays the sampling rate. The value is automatically set according to the parameter "Number of Resource Blocks Per Slot".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:SRATe` on page 415

**Number Of Occupied Subcarriers (UL)**
Displays the number of occupied subcarriers. The value is automatically set according to the parameter "Number of Resource Blocks Per Slot".

See also table 4-1 for an overview ot this cross-reference between the parameters.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:OCCSubcarriers?` on page 416

**Number Of Left Guard Subcarriers (UL)**
Displays the number of left guard subcarriers. This value is set automatically according to the parameter "Number of Resource Blocks Per Slot".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:LGS?` on page 416

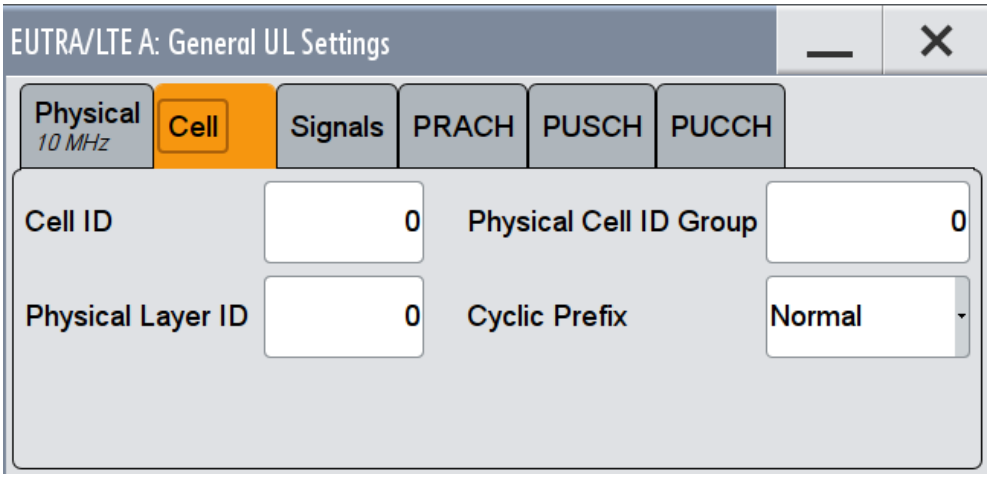
**Number Of Right Guard Subcarriers (UL)**
Displays the number of right guard subcarriers. This value is set automatically according to the parameter "Number of Resource Blocks Per Slot".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:RGS?` on page 416

### 7.14.2 Cell Specific Settings

1. To access this dialog, select "General > Link Direction > Uplink (SC-FDMA)".

2. Select "General UL > Cell "




This dialog comprises the settings needed for configuring the physical layer cell ID settings, the UL Reference Signal settings, the PUSCH, PUCCH and PRACH structures are selected, as well as cell-specific SRS parameters.

Provided are the following settings:

**Cell ID (UL)**
Sets the cell identity.

There are 504 unique physical layer cell identities (Cell ID), grouped into 168 unique physical cell identity groups that contain three unique identities each. The Cell ID is calculated as following:

Cell ID = 3*Physical Cell ID Group + Physical Layer ID

There is a cross-reference between the values of this three parameters and changing of one of them results in adjustment in the values of the others.

The Cell ID determinates:
- the reference signal grouping hopping pattern,
- the reference signal sequence hopping,
- the PUSCH demodulation reference signal pseudo-random sequence,
- the cyclic shifts and scrambling sequences for all PUCCH formats
- the pseudo-random sequence used for scrambling
- the pseudo-random sequence used for type 2 PUSCH frequency hopping.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:PLCi]:CID` on page 417

**Physical Cell ID Group (UL)**
Sets the ID of the physical cell identity group.

To configure these identities, set the parameter Physical Layer ID.

The physical layer cell identities determine the sequence shift pattern used for PUCCH.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:PLCi]:CIDGroup` on page 417

**Physical Layer ID (UL)**
Sets the identity of the physical layer within the selected physical cell identity group, set with parameter Physical Cell ID Group.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL[:PLCi]:PLID on page 417

**Cyclic Prefix (General UL Settings)**
Sets the cyclic prefix length for all subframes.

The number of the SC-FDMA symbols is set automatically.

"Normal" Normal cyclic prefix, i.e. the UL slot contains 7 SC-FDMA symbols.

"Extended" Extended cycic prefix, i.e. the UL slot contains 6 SC-FDMA symbols. The extended cyclic prefix is defined in order to cover large cell scenarios with higher delay spread and MBMS transmission.

"User Defined" The cyclic prefix length can vary over the subframes. The cyclic prefix length is set per subframe in the "UL Frame Configuration" dialog with the paramter Cyclic Prefix.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:CPC on page 418

**UL/DL Cyclic Prefix**
In "Duplexing > TDD", determines the cyclic prefix for the appropriate opposite direction.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:DLCPc on page 418
[:SOURce<hw>]:BB:EUTRa:DL:ULCPc on page 409

### 7.14.3 TDD Frame Structure Settings

The "TDD Frame Structure" section is available only, if the TDD is selected as a duplexing mode. In this section, the TDD frame is configured by means of adjustment of the UL/DL configuration and the special subframe configuration (see also chapter 3.2.1, "OFDMA Parameterization", on page 18).

**UL/DL Configuration**
Sets the Uplink-Downlink Configuration number, i.e. defines which subframe is used for downlink respectively uplink, and where the special subframes are located.

Remote command:
[:SOURce<hw>]:BB:EUTRa:TDD:UDConf on page 399

**Configuration of Special Subframes**
Sets the Special Subframe Configuration number, i.e. together with the parameter Cyclic Prefix defines the lengths of the DwPTS, the Guard Period and the UpPTS.

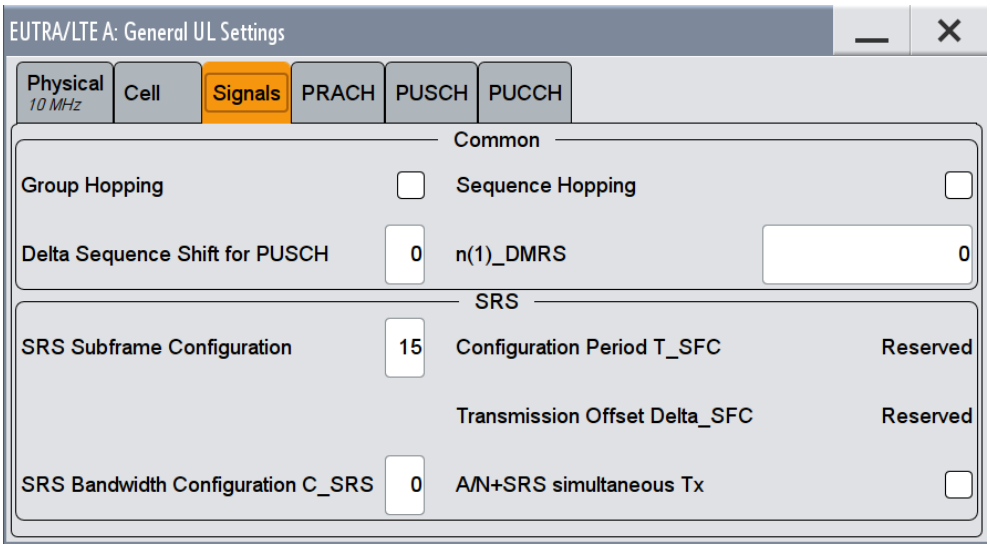
The DwPTS length selected with this parameter determines the maximum number of the OFDM symbols available for PDSCH in the special subframe.

The UpPTS length selected with this parameter determines the maximum number of the SC-FDMA symbols available for SRS in the special subframe.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TDD:SPSConf` on page 399

## 7.14.4 Signals Settings

1. To access this dialog, select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "General UL > Signals"




This dialog comprises the settings needed for configuring the uplink reference signals and the SRS structure.

### 7.14.4.1 UL Reference Signals

**Group Hopping**
Enables/disables group hopping for the uplink reference signals demodulation reference signal (DMRS) and sounding reference signal (SRS).

17 different hopping patterns and 30 different sequence shift patterns are used for group hopping.

PUSCH and PUCCH use the same group hopping pattern that is calculated if the "Group Hopping" is enabled. The group hopping pattern is generated by a pseudo-random sequence generator.

The sequence shift pattern of PUCCH is derived from the physical layer cell ID set as a combination of the parameters Physical Cell ID Group and Physical Layer ID.

The PUSCH sequence shift pattern is determinate by the parameter Delta Sequence Shift for PUSCH.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:GRPHopping on page 418

**Sequence Hopping**
Enables/disables sequence hopping for the uplink reference signals demodulation reference signal (DRS) and sounding reference signal (SRS).

Sequence Hopping and Group Hopping can be activated simultaneously, but only group hopping will be applied in this case, as defined in 3GPP TS 36.211.

The sequence hopping is generated by a pseudo-random sequence generator.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SEQHopping on page 419

**Delta Sequence Shift for PUSCH**
Sets the delta sequence shift for PUSCH needed for the calculation of the group hopping pattern.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DSSHift on page 419

**n(1)_DMRS**
Sets the part of the demodulation reference signal (DMRS) index which is broadcasted and therefore valid for the whole cell. This index applies when multiple shifts within a cell are used and is used by the calculation of the DMRS sequence.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DMRS on page 419

#### 7.14.4.2 SRS Structure

The cell specific parameters in this section determine the structure of the sounding reference signal (SRS) according to the 3GPP TS 36.211.

The UE-specific parameters, necessary for the complete definition of the SRS structure and SRS mapping, are configurable in the User Equipment Configuration dialog of the corresponding UE.

**SRS Subframe Configuration**
Sets the cell specific parameter SRS subframe configuration.

This parameter can also influence the shortening of PUCCH/PUSCH transmissions, regardless whether the UEs are configured to send a SRS in the according subframe or not.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:SUConfiguration on page 421

**Configuration Period T_SFC**
Displays the value for the cell specific parameter configuration period $T_{SFC}$ in subframes, depending on the selected "SRS Subframe Configuration" and the "Duplexing" mode.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:TSFC?` on page 421

**Transmission Offset Delta_SFC**
Displays the value for the cell specific parameter transmission offset $Delta_{SFC}$ in subframes, depending on the selected "SRS Subframe Configuration" and the "Duplexing" mode.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:DSFC?` on page 420

**SRS Bandwidth Configuration C_SRS**
Sets the cell specific parameter SRS Bandwidth Configuration ($C_{SRS}$).

The SRS Bandwidth Configuration $C_{SRS}$, theSRS Bandwidth B_SRS and the Channel Bandwidth (UL) determine the length of the sounding reference signal sequence, calculated according to 3GPP TS 36.211.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:CSRS` on page 420

**A/N + SRS simultaneous Tx**
Enables/disables simultaneous transmission of SRS (sounding reference signal) and ACK/NACK messages, i.e. transmission of SRS and PUCCH in the same subframe.

Simultaneous transmission of SRS and PUCCH is allowed only for PUCCH formats 11, 1a, 1b and 3, since CQI reports are never simultaneously transmitted with SRS.

If this parameter is disabled, the SRS is not transmitted in the corresponding subframe.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:ANSTx` on page 419

**SRS MaxUpPTS**
Enables/disables the cell specific parameter srsMaxUpPts.

If enabled, a SRS transmission in the UpPTS field (TDD) is made only in the frequency area that does not overlap with the frequency resources reserved for a possible PRACH preamble format 4 transmission.

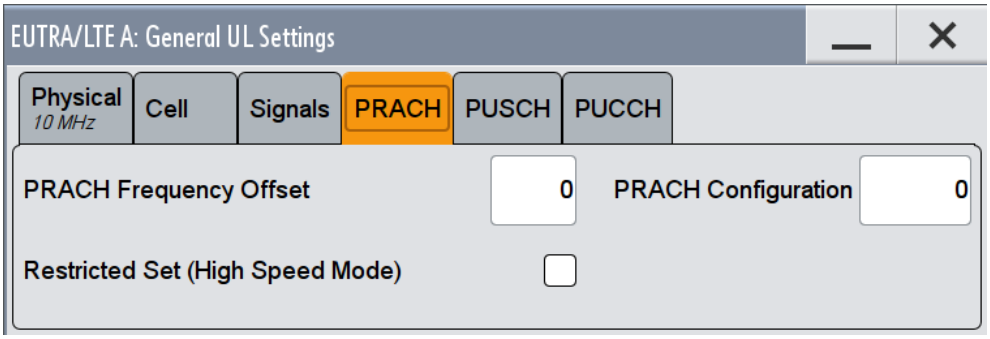
This is done by reconfiguring the number of SRS resource blocks in the special subframes, which would otherwise be determined by C_SRS and B_SRS.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:MUPTs` on page 420

### 7.14.5 PRACH Settings

1. To access this dialog, select "General > Link Direction > Uplink (SC-FDMA)".

2. Select "General UL > PRACH"




This dialog comprises the cell specific parameters that determine the PRACH configuration according to the 3GPP TS 36.211.

The UE-specific parameters, necessary for the complete definition of the PRACH, are configurable in the User Equipment Configuration dialog of the corresponding UE.

**PRACH Frequency Offset**
For preamble formats 0-3, sets the prach-FrequencyOffset $n^{RA}_{PRBoffset}$ as defined in the 3GPP TS 36.211, i.e. determines the first physical resource block available for PRACH expressed as a physical resource block number that fulfills the equation:

$0 <= n^{RA}_{PRBoffset} <=$ Number of UL Resource Blocks - 6

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:PRACh:FOFFset` on page 422

**PRACH Configuration**
Sets the PRACH configuration index as defined in the 3GPP TS 36.211, i.e. defines the time and frequency resources in which random access preamble transmission is allowed.

The PRACH allocation occupies a bandwidth of 6 RBs.

However, the PRACH distribution (subframe, length, offset) depends on several other parameters:

- selected "Cyclic Prefix"
- selected PRACH Frequency Offset
- selected frame format, i.e. on the selected Duplexing mode
- selected Frequency Resource Index (for TDD mode).

Not all combinations of channel bandwidth, PRACH configuration and PRACH frequency offset are allowed.

The table below gives an overview on the dependency of the value range of the parameter "PRACH Configuration" and other parameters.

| Duplexing Mode | Configuration of Special Subframes | (Global) Cyclic Prefix | PRACH Configuration |
|---|---|---|---|
| FDD | - | Normal/Extended | 0 .. 63 |
| TDD | 0 .. 3 | Normal/Extended | 0 .. 47 |
| | 4 | Normal | 0 .. 47 |

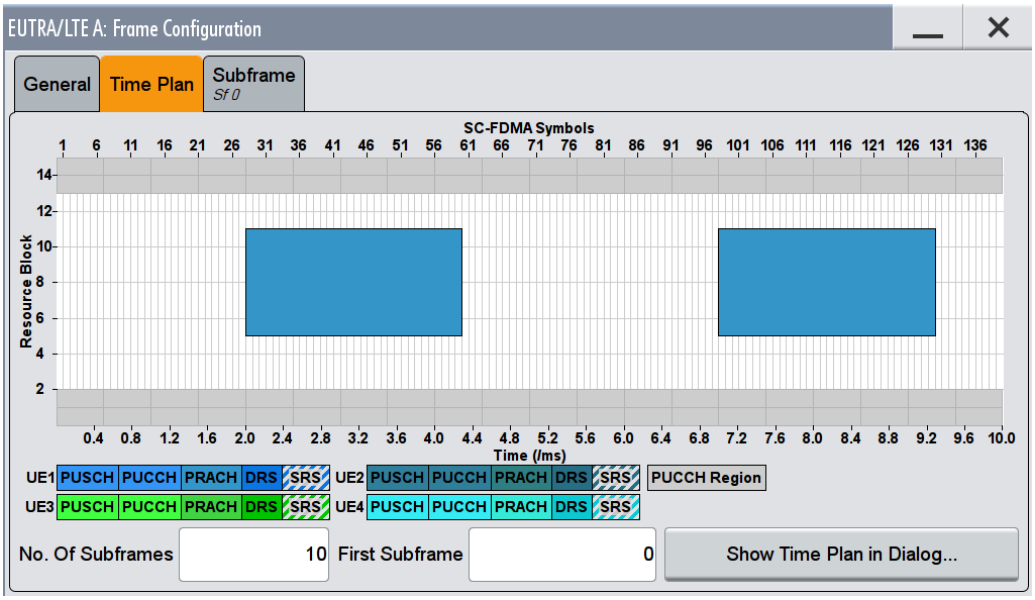
| Duplexing Mode | Configuration of Special Subframes | (Global) Cyclic Prefix | PRACH Configuration |
|---|---|---|---|
| | 4 | Extended | 0 .. 57 |
| | 5 .. 8 | Normal/Extended | 0 .. 57 |

The Preamble Format is automatically derived form the "PRACH Configuration".

Use the SC-FDMA Time plan to display the PRACH distribution.

**Example:**

The timeplan below illustrates the PRACH distribution of a PRACH Configuration#55 (Preamble Format#3) for FDD duplexing mode and normal "Cyclic Prefix "with adjusted PRACH frequency Offset.




Remote command:

[:SOURce<hw>]:BB:EUTRa:UL:PRACh:CONFiguration on page 421

**Restricted Set (High Speed Mode)**

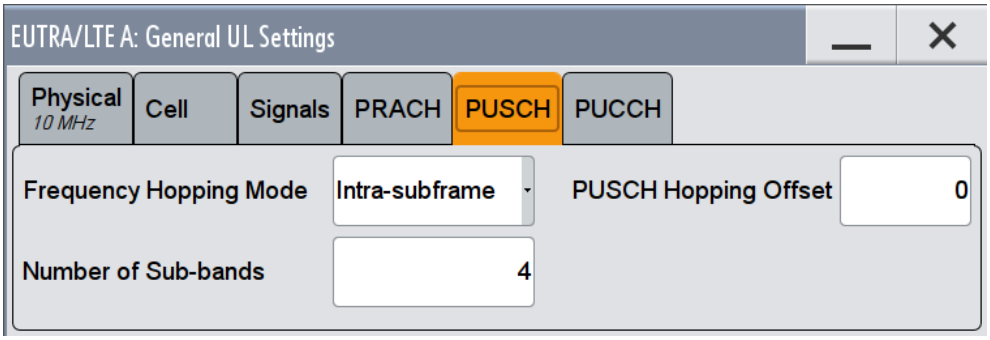
Selects whether a restricted preamble set (high speed mode) or the unrestricted preamble set (normal mode) will be used.

Remote command:

[:SOURce<hw>]:BB:EUTRa:UL:PRACh:RSET on page 422

## 7.14.6 PUSCH Structure

1. To access this dialog, select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "General UL > PUSCH".




Provided are the follwoing settings:

**Frequency Hopping Mode**
Sets the frequency hopping mode for PUSCH.

Frequency hopping is applied according to 3GPP TS 36.213.

| | |
|---|---|
| "Inter-sub-frame" | The PUSCH position in terms of used resource blocks is changed each subframe. |
| "Intra-sub-frame" | Both intra- and inter-subframe hopping are performed.<br>The PUSCH position in terms of used resource blocks is changed each slot and each subframe. |

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:PUSCh:FHMode` on page 422

**PUSCH Hopping Offset**
Sets the PUSCH Hopping Offset $N_{RB}^{HO}$.

The PUSCH Hopping Offset determines the first physical resource block and the maximum number of physical resource blocks available for PUSCH transmission if PUSCH frequency hopping is used.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:PUSCh:FHOFfset` on page 423

**Number of Sub-bands**
Sets the number of sub-bands ($N_{sb}$) into that the total range of physical resource blocks available for PUSCH transmission is divided. The frequency hopping is performed at sub-band level.

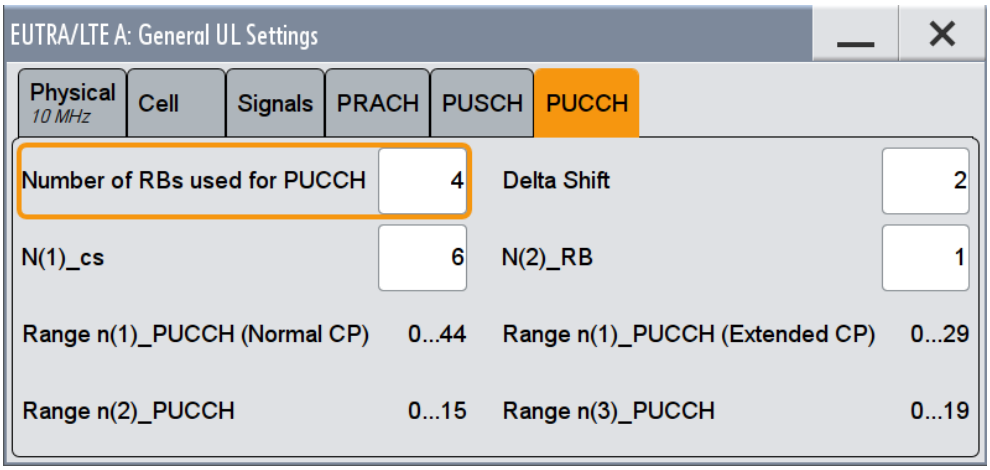
The size of one sub-band is determinate by the number of resource blocks available for PUSCH transmission, the "Number of Sub-bands" and the PUSCH hopping parameters.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:PUSCh:NOSM` on page 423

### 7.14.7 PUCCH Structure

1. To access this dialog, select "General > Link Direction > Uplink (SC-FDMA)".

2. Select "General UL > PUCCH".



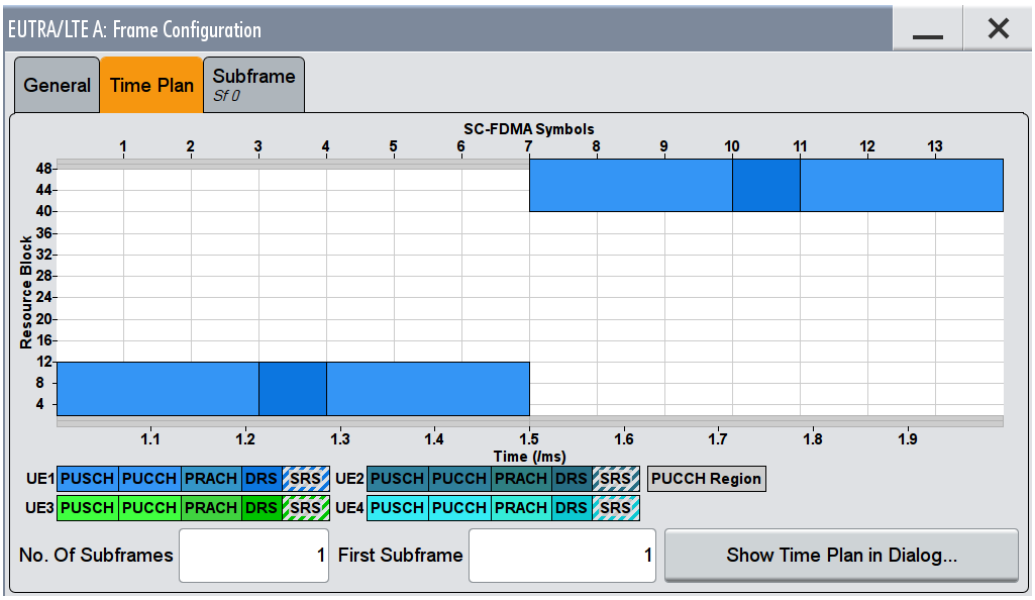

Provided are the follwoing settings:

**Number of RBs used for PUCCH**
Sets the PUCCH region in terms of reserved resource blocks, located at the edges of the channel bandwidth (see figure 3-18).

The PUCCH region is displayed on the SC-FDMA Timeplan.

**Example:**

The figure below shows an example of a subframe with PUCCH region with three reserved resource blocks and PUCCH Format 2a.




Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:NORB on page 424

**Delta Shift**
Sets the delta shift parameter, i.e. the cyclic shift difference between two adjacent PUCCH resource indices with the same orthogonal cover sequence (OC).

The delta shift determinates the number of available sequences in a resource block that can be used for PUCCH formats 1/1a/1b (see also chapter 3.3.3, "Uplink Control Information Transmission", on page 32).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:DESHift` on page 424

**N(1)_cs**
Sets the number of cyclic shifts used for PUCCH format 1/1a/1b in a resource block used for a combination of the formats 1/1a/1b and 2/2a/2b.

Only one resource block per slot can support a combination of the PUCCH formats 1/1a/1b and 2/2a/2b.

The number of cyclic shifts available for PUCCH format 2/2a/2b N(2)_cs in a block with combination of PUCCH formats is calculated as follow:

N(2)_cs = 12 - N(1)_cs -2

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N1CS` on page 424

**N(2)_RB**
Sets bandwidth in terms of resource blocks that are reserved for PUCCH formats 2/2a/2b transmission in each subframe.

Since there can be only one resource block per slot that supports a combination of the PUCCH formats 1/1a/1b and 2/2a/2b, the number of resource block(s) per slot available for PUCCH format 1/1a/1b is determinate by "N(2)_RB".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N2RB` on page 424

**Range n(1)_PUCCH (Normal CP)**
Displays the range of the possible PUCCH format 1/1a/1b transmissions from different users in one subframe and in case of normal CP.

Insufficient ranges are displayed as '-'.

This parameter determines the value range of index n_PUCCH for PUCCH format 1/1a/1b in case of normal cyclic prefix.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N1NMax` on page 425

**Range n(1)_PUCCH (Extended CP)**
Displays the range of the possible PUCCH format 1/1a/1b transmissions from different users in one subframe and in case of Extended CP.

Insufficient ranges are displayed as '-'.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N1EMax` on page 425

**Range n(2)_PUCCH**
Displays the range of possible number of PUCCH format 2/2a/2b transmissions from different users in one subframe.

Insufficient ranges are displayed as '-'.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N2Max` on page 425

**Range n(3)_PUCCH**
Displays the range of possible number of PUCCH format 3 transmissions from different users in one subframe.

Insufficient ranges are displayed as '-'.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N3Max` on page 426

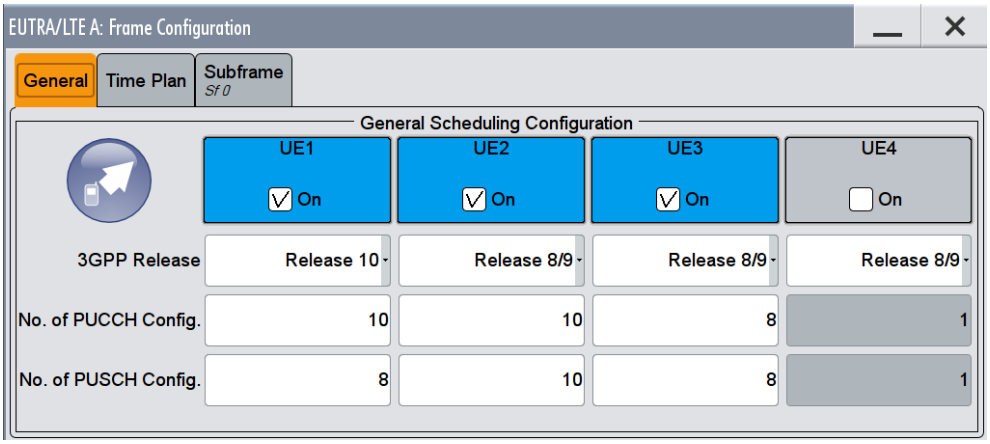
## 7.15 UL Frame Configuration Settings

1. To access this dialog, select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration "

   This dialog allows configuring the subframes and the SC-FDMA resource allocations.

### 7.15.1 General Scheduling Configuration Settings

1. To access this dialog, select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > General "




This dialog provides access to the user equipment settings as well as settings concerning the UL scheduling, like configuring the subframes and adjusting the PUCCH/PUSCH scheduling.

**Select User Equipment (UE1...UE4)**
Accesses the User Equipment Configuration dialog for configuring the different users.

The check box activates or deactivates the selected UE. The 3GPP release the UE is compliant to is displayed.

**Note:** Disabling the UE deactivates the corresponding allocations. Neither reference signal, nor PUSCH/PUCCH allocations, nor PRACH will be transmitted if an UE is deactivated.

Remote command:
n.a.

**3GPP Release**
requires option R&S SMW-K85 (LTE-A Rel. 10)

Determines whether the selected UE is a LTE Release 8/9 or LTE Release 10 UE. Several further settings are enabled only for Rel. 10 UEs (e.g. see chapter 7.15, "UL Frame Configuration Settings", on page 215).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:RELease` on page 515

**Number Of PUCCH/PUSCH Configations/Number Of Configurable Subframes**
Sets the number of configurable subframes in the up to four configurable frames, i.e determines the scheduling cycle per UE.

All uplink subframes are filled periodically with the configured subframes with the exception of the Sounding Reference Signal. SRS is set individually for each UE in the User Equipment Configuration dialog.

The maximum number of configurable subframes depends on the selected Duplexing mode (TDD or FDD), TDD Frame Structure Settings and whether a realtime feedback is enabled or not.

For more detailed information about the maximum number of configurable subframes and for description of the dependencies between the parameters, see chapter 5.2.3, "Four Configurable Frames in Uplink and Downlink Direction", on page 55.

For "Rel 8/9" UEs, the "No Of Configurable Uplink Subframes" is the same for PUCCH and PUSCH.

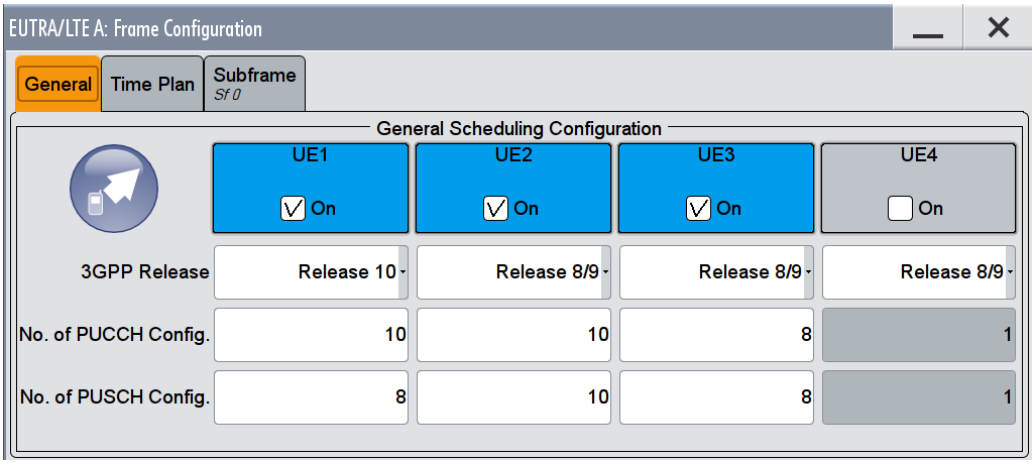
In instruments equipped with R&S SMW-K85, for the LTE Rel 10 UEs, the scheduling cycles are additionally independent per PUSCH and PUCCH, i.e. the number of configurable subframes can be defined individually per PUCCH and per PUSCH. This enables the configuration of PUCCH and PUSCH with different repetition patterns.

**Example: Independent cycles for PUSCH and PUCCH of the same LTE Rel. 10 UE**

As described in the test case 8.2.4, TS 36.141 [6], the PUCCH of the UE has to be transmitted once a frame and the PUSCH - once each eight subframes.

- Set "UE1 > User Equipment Configuration > 3GPP Release" = Release 10.
- In the "UL Frame Configuration > Number of Configurable Uplink Subframes" dialog, set "UE1 > PUCCH" = 10
- In the "UL Frame Configuration > Number of Configurable Uplink Subframes" dialog, set "UE1 > PUSCH" = 8
- Configure the PUCCH and PUSCH allocations of UE1 as required.

**Example: Independent cycles for PUSCH and PUCCH of the same LTE Rel. 8/9 UE**




- Select "UE2 > User Equipment Configuration > UE ID/n_RNTI (User Equipment)" = UE $ID_{UE2}$.
- Set "UE3 > User Equipment Configuration > UE ID/n_RNTI (User Equipment)" = UE $ID_{UE2}$
- Configure the allocations of as required.
- In the "UL Frame Configuration > Number of Configurable Uplink Subframes" dialog, set "UE2 > PUCCH/PUSCH" = 10
- In the "UL Frame Configuration > Number of Configurable Uplink Subframes" dialog, set "UE3 > PUCCH/PUSCH" = 8

Remote command:

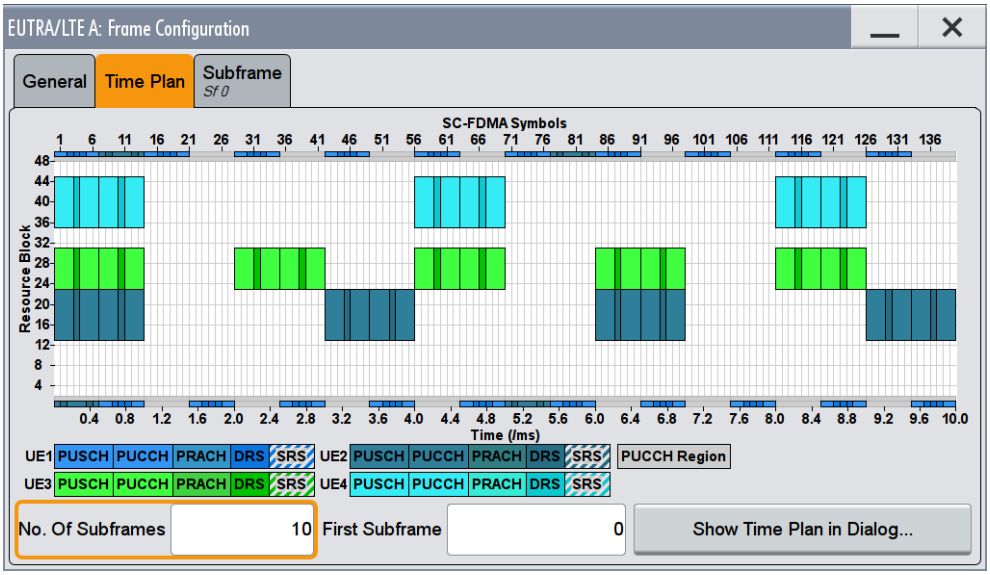
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:CONSubframes:PUCCh` on page 494

`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:CONSubframes:PUSCh` on page 494

## 7.15.2 SC-FDMA Timeplan

1. To access this dialog, select "General > Link Direction > Uplink (SC-FDMA)".

2. Select "Frame Configuration > Time Plan"




This dialog shows the time plan for SC-FDMA

The x-axis shows allocation in the time domain. The y-axis shows the resource blocks as smallest allocation granularity in the frequency domain. One allocation of a UE can span 1 to up to "No. of Resource Blocks" in the frequency domain.

Sounding Reference Signals are automatically calculated according to the settings for signal structure in "User Equipment".

**First Subframe**
Selects the first subframe to be displayed.

Remote command:
n.a.

**No. of Subframes**
Selects the number of subframes to be displayed.

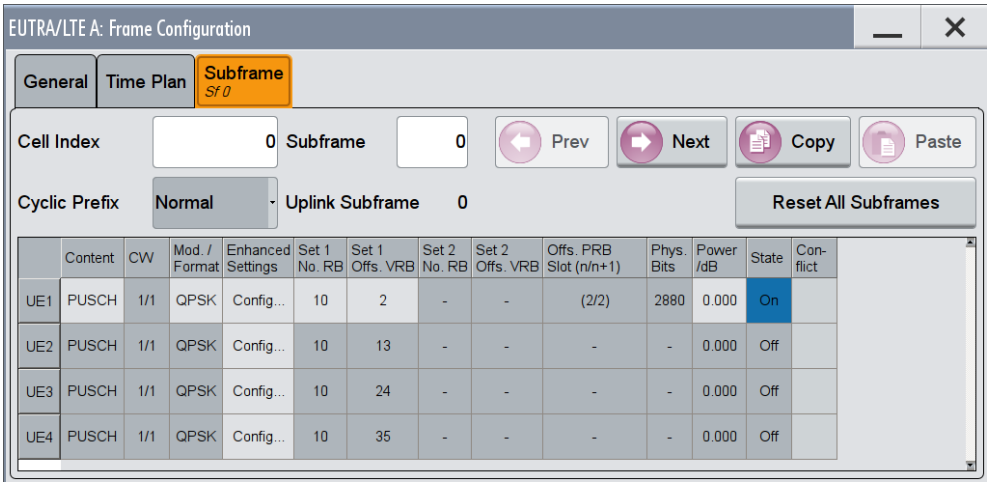
Remote command:
n.a.

**Show Time Plan in Dialog**
Enlarges the time plan display.

## 7.15.3 Subframe Configuration

1. To access this dialog, select "General > Link Direction > Uplink (SC-FDMA)".

2. Select "Frame Configuration > Subframe"




This dialog comprises the settings for selecting and configuring the subframes. In the allocation table section the individual allocation parameters for a subframe are set.

Provided are the following settings:

**Cell Index**
Displays the cell index.

Remote command:
n.a.

**Subframe**
Sets the subframe to be configured/displayed in the frame configuration table. All uplink subframes are filled periodically with the configured subframes with the exception of the Sounding Reference Signal. SRS is set individually for each UE in the User Equipment Configuration dialog.

Subframes behind the configurable range of the corresponding UE or channel (Number Of PUCCH/PUSCH Configations/Number Of Configurable Subframes) are displayed as read-only.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:SFSelection` on page 495

**Next/Prev**
Navigates through the subframes.

Remote command:
n.a.

**Copy/Paste Subframe Settings**
Copies/pastes the settings of the selected subframe. Sounding Reference Signals are not considered.

For more detailed information, see chapter 5.2.1, "Copy/Paste Subframe", on page 55.

Remote command:
n.a.

**Cyclic Prefix (UL)**
Configuration of the cyclic prefix per subframe is only enabled, if the parameter Cyclic Prefix (General UL Settings) is set to User Defined.

The number of the SC-FDMA symbols per subframe is set automatically

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:CYCPrefix` on page 495

**Subframe Information**
Displays the kind of the selected subframe, i.e. "Special Subframe", "Uplink Subframe", "Downlink Subframe".

For "Uplink Subframe", it is also shown the uplink subframe number, which is especially useful for TDD duplexing mode.

Remote command:
n.a.

**Reset All Subframes**
Resets settings of all subframes including cyclic prefix to the default values.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:RSTFrame` on page 495

### 7.15.4 UL Allocation Table

The resource allocation table is located in the lower part of the "UL Frame Configuration" dialog. The resource allocation table is where the individual allocation parameters for a subframe are set.

**Content (UL)**
Selects the content type of the selected allocation.

Data source settings for PUSCH is configurable in dialog chapter 7.16, "User Equipment Configuration", on page 224.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:CONType`
on page 496

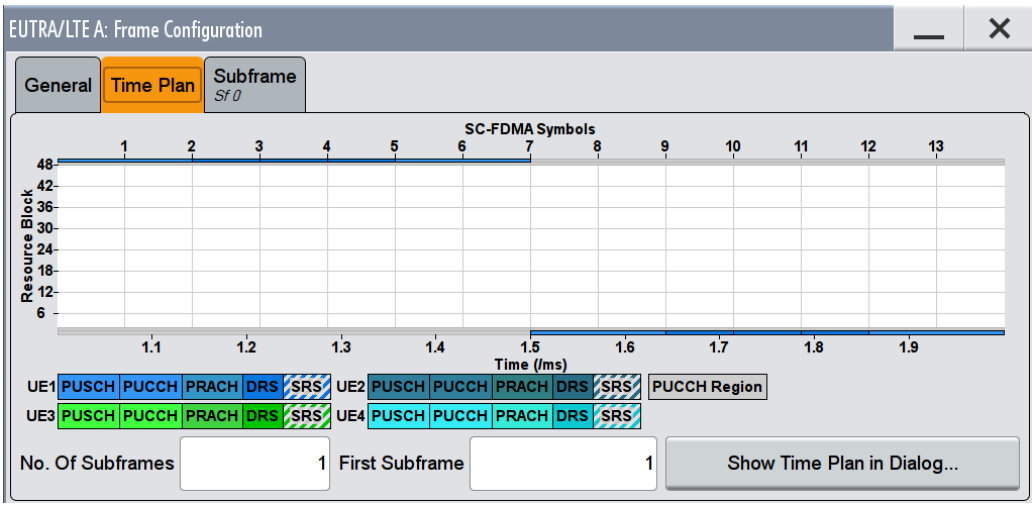
**Codeword (UL)**
Determines whether one or two codewords use the same physical resource, and whether CW#1 or CW#2 is configured with the selected PUSCH allocation.

Remote command:
n.a.

**Modulation/Format**
For PUSCH allocation, this parameter sets the modulation scheme (QPSK, 16QAM or 64QAM) for the allocation.

This parameter is read-only, if a predefined FRC is selected.

For PUCCH allocation, this parameter sets the PUCCH Format (1/1a/1b/2/2a/2b/3). See chapter 3.3.3, "Uplink Control Information Transmission", on page 32 for an overview of the allowed PUCCH formats. Use the SC-FDMA Time plan to visualize the position and structure of the configured PUCCH allocation.




Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:MODulation`
on page 496
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:FORMat`
on page 496

**Enhanced Settings UL**
Calls dialog for configuration of PUSCH/PUCCH depending on the selected allocation (see chapter 7.17, "Enhanced PUSCH Settings", on page 250 and chapter 7.18, "Enhanced PUCCH Settings", on page 256).

Remote command:
n.a.

**Set 1/Set 2 No. RB**
Requires option R&S SMW-K85 LTE-A (Rel. 10)

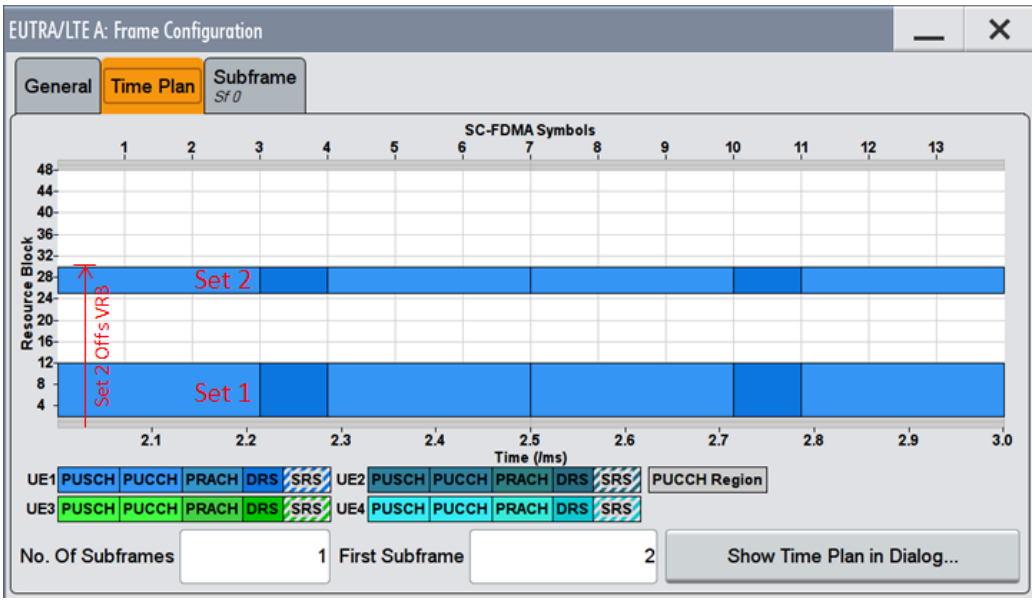
The LTE Rel. 10 specification defines PUSCH transmission not only in a continuous frequency region but also in two "sets" or "clusters" of resource blocks (see figure 3-26).

This parameters defines the size of the selected allocation in resource blocks of the corresponding set.

This parameter is read-only, if a predefined FRC is selected.

**Example: Clustered PUSCH Tranmission**

- Select "User Equipment Configuration (UE1) > 3GPP Release > Rel.10".
- In the "UL Frame Configuration > Allocation Table", configure the PUSCH allocation of UE1 as follow:
  – "Set 1 No. RB" = 10, "Set 1 Offs. VRB" = 2
  – "Set 2 No. RB" = 5, "Set 2 Offs. VRB" = 25
  – "State" = ON
- Select "Show Time Plan" to visualize the configured allocations




Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:RBCount`
on page 496
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:RBCount?`
on page 496
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:SET<user>:RBCount` on page 496

**Set 1/Set 2 Offset VRB**
Requires optionR&S SMW-K85 LTE-A (Rel. 10)

For the corresponding set, sets the virtual resource block offset of the selected subframe (see also example "Clustered PUSCH Tranmission" on page 222).

This parameter is read-only, if a predefined FRC is selected.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:VRBoffset`
on page 497
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:SET<user>:VRBoffset` on page 497

**Offs PRB Slot (n/n+1)**
Displays the start resource block of the selected allocation in the first and the second slot of the subframe.

The start physical resource block in slot n and slot n+1 are set automatically and can deviate from the Set 1/Set 2 Offset VRB if frequency hopping is used.

In case an intra-subframe hopping for hopping type 2 is applied, the start resource block in slot 1 is determinate by the selected Number of Sub-bands.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:SLOT<user0>:ALLoc<ch0>:RBOFfset?` on page 497
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:SLOT<user0>:ALLoc<ch0>:PUCCh:RBOFfset?` on page 497
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:SLOT<user0>:ALLoc<ch0>:PUSCh:SET<s2us>:RBOFfset?` on page 497

**Phys. Bits / Total Number of Physical Bits**
Displays the size of the selected allocation in bits. The value is set automatically according to the current allocation's settings.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PHYSbits?` on page 498
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:PHYSbits?` on page 498
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:PHYSbits?` on page 498

**Power (UL)**
Sets the power for the selected allocation, i.e. PUSCH or PUCCH power level.

The PUSCH power level ($P_{PUSCH}$) and the PUCCH power level ($P_{PUCCH}$) can vary per subframe.

For global adjustment of the transmit power of the corresponding UE, use the parameter UE Power ($P_{UE}$).

An additional boost of the reference signals DRS and SRS per UE can be applied with the parameters DRS Power Offset ($P_{DRS\_offset}$) and SRS Power Offset ($P_{SRS\_offset}$) respectively.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:POWer` on page 498
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:POWer` on page 498
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:POWer` on page 498

**State (UL)**
Sets the allocation to active or inactive state.

**Note:** Disabling an allocation deactivate the PUSCH/PUCCH and the corresponding demodulation reference signal, but does not affect other allocations of the UE or the sounding reference signal.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:STATe` on page 499
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:STATe` on page 499
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:STATe` on page 499

**Conflict (UL)**
Indicates a conflict between UEs and in case an allocation exceeds the available number of resource blocks.

For more information, see chapter 5.1, "Conflict Handling in the R&S Signal Generator", on page 51.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:CONFlict?` on page 499
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CONFlict?` on page 499
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CONFlict?` on page 499

## 7.16 User Equipment Configuration

1. To access this dialog, select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > General > Select User Equipment > UE1... UE4"

   This dialog allows you to define and configure up to four scheduled user equipments that can be freely distributed over the time. For each user equipment, the structure of the demodulation reference signal and the sounding reference signal can be configured individually.

Section "Realtime Feedback Configuration" provides an access to the parameters required for generating signals in accordance to the HARQ feedback or UL timing adjustments test cases.

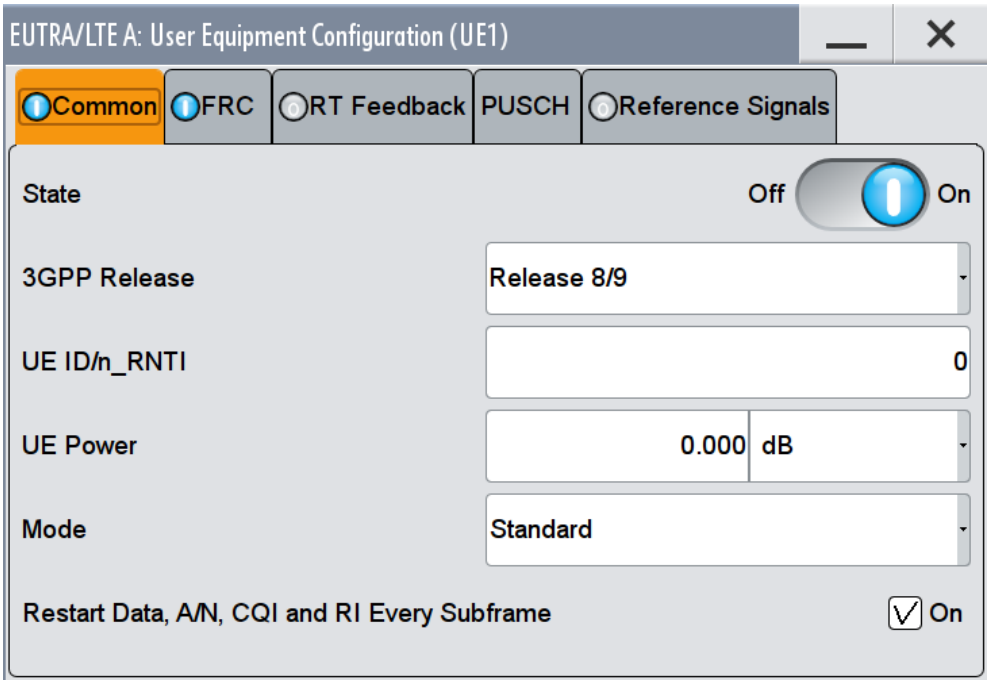
The "Realtime Feedback Configuration" is enabled only for UE1 in instruments equipped with the option R&S SMW-K69.

"Realtime Feedback Configuration" is not available for the R&S Signal Generator SMBV and for the simulation software R&S WinIQSIM2.

### 7.16.1 Common Settings

To access this dialog,

1. select "General > Link Direction > Uplink (SC-FDMA)"
2. select "Frame Configuration > General > Select User Equipment > UE1... UE4"
3. select "Common"




In this dialog the state of the user equipment, the UE's release, UE ID and the operational mode can be set.

**State (User Equipment)**
Activates or deactivates the user equipment.

**Note:** Disabling the UE deactivates the corresponding allocations. Neither reference signal, nor PUSCH/PUCCH allocations, nor PRACH will be transmitted if an UE is deactivated.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:STATe` on page 516

**3GPP Release**
requires option R&S SMW-K85 (LTE-A Rel. 10)

Determines whether the selected UE is a LTE Release 8/9 or LTE Release 10 UE. Several further settings are enabled only for Rel. 10 UEs (e.g. see chapter 7.15, "UL Frame Configuration Settings", on page 215).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:RELease` on page 515

**UE ID/n_RNTI (User Equipment)**
Sets the radio network temporary identifier (RNTI) of the UE.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:ID` on page 516

**UE Power**
Sets the power level of the selected UE (PUE).

The UE power level determines the power levels of the reference signals (DRS and SRS) and the power level of the allocations (PUSCH ($P_{PUSCH}$) and PUCCH ($P_{PUCCH}$)).

The UE power level can be used for global adjustment of the transmit power of the corresponding UE.

The PUSCH and PUCCH Power level can vary per subframe.

An additional boost of the reference signals DRS and SRS per UE can be applied with the parameters DRS Power Offset ($P_{DSR\_offset}$) and SRS Power Offset ($P_{SRS\_offset}$) respectively.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:POWer` on page 517

**Mode**
Selects whether the user equipment is in standard or in PRACH mode.

"Standard" Sets the operational mode of the user equipment to standard.

"PRACH" Sets the operational mode of the user equipment to PRACH (see chapter 7.16.9, "PRACH Configuration", on page 247).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:MODE` on page 516

**Restart Data, A/N, CQI and RI every subframe**
If activated, the data source, the ACK/NACK pattern, the CQI pattern and RI are restarted every subframe.

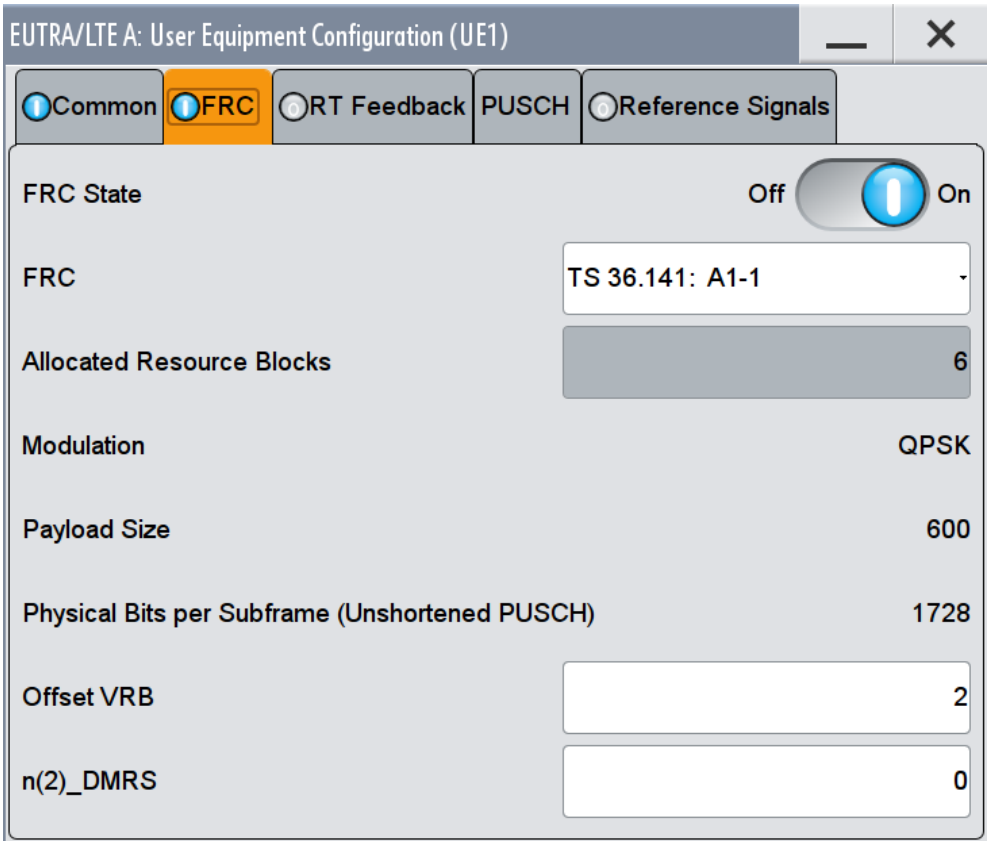
This parameter is always enabled, if realtime feedback is active.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:DACRestart` on page 515

## 7.16.2 FRC Configuration

1. To access this dialog, select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > General > Select User Equipment > UE1... UE4"

3. Select "FRC"




This dialog enables a quick configuration of the predefined fixed reference channels (FRC) according to 3GPP TS 36.141, Annex A "Reference Measurement channels", respectively 3GPP TS 36.521-1, Annex A.

When "FRC Configuration" is enabled, several parameters are predefined and their values are displayed as read-only. The table below gives an overview of the parameters that are affected by the FRC configuration.

| Dialog | Parameter | Value |
|---|---|---|
| "UE Configuration" | Scrambling | On |
| | Channel Coding State | On |
| | Interleaver | On |
| | SRS State | Off (the SRS can be activated manually if FRC state is ON) |
| "UL Allocation Table" | Modulation | According to the selected FRC |
| PUSCH allocations of the corresponding UE in all subframes | No. RB | According to the selected FRC |
| "Enhanced PUSCH Settings" | Frequency Hopping | Off |
| For the corresponding UE in all subframes | HARQ ACK Type | None |

| Dialog | Parameter | Value |
|---|---|---|
| | Number of CQI Bits | 0 |
| | Number of coded CQI Bits | 0 |
| | Transport Block Size/Payload | According to the selected FRC |

**FRC State**
Enables/disables FRC configuration.

Enabling FRC configuration sets some parameters to their predefined values, i.e. several parameters are displayed as read-only. Reconfiguration of the values of these parameters is possible only after disabling the FRC configuration. An exception is the SRS state that can be changed even while a FRC configuration is enabled.

The FRC State is disabled and cannot be enabled, if a "User Defined"Cyclic Prefix is selected.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:STATe` on page 518

**FRC**
Selects a predefined fixed reference channel according to 3GPP TS 36.141, Annex A respectively 3GPP TS 36.521-1, Annex A.

Since the predefined FRCs require minimum channel bandwidth and predefined cyclic prefix, the currently available FRCs are limited by the selected Number of RBs per Slot andCyclic Prefix . The FRC State is disabled and there are no FRCs available for selection, if a "User Defined" cyclic prefix is selected.

***Table 7-12: Supported FRCs from 3GPP TS 36.141***

| FRC | Description |
|---|---|
| A1_1 .. A1_5 | Fixed Reference Channels for reference sensitivity and in-channel selectivity (QPSK, R=1/3). |
| A2_1 .. A2_3 | Fixed Reference Channels for dynamic range (16QAM, R=2/3). |
| A3_1 .. A3_7 | Fixed Reference Channels for performance requirements (QPSK 1/3). |
| A4_1 .. A4_8 | Fixed Reference Channels for performance requirements (16QAM 3/4) |
| A5_1 .. A5_7 | Fixed Reference Channels for performance requirements (64QAM 5/6). |
| A7_1 .. A7_6 | Fixed Reference Channels for UL timing adjustment (Scenario 1). |
| A8_1 .. A8_6 | Fixed Reference Channels for UL timing adjustment (Scenario 2). |

***Table 7-13: Supported FRCs from 3GPP TS 36.521-1***

| FRC | Description |
|---|---|
| A.2.2.1.1 | Reference Channels for QPSK with full RB allocation. |
| A.2.2.1.2 | Reference Channels for 16-QAM with full RB allocation. |
| A.2.2.2.1 | Reference Channels for QPSK with partial RB allocation. |

| FRC | Description |
|---|---|
| A.2.2.2.2 | Reference Channels for 16-QAM with partial RB allocation. |
| A.2.2.3 | Uplink Reference Channels for sustained data-rate test. |

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:TYPE on page 519

**Allocated Resource Blocks**
Displays the number of the allocated resource blocks for the selected FRC. For FRCs "A.2.2.2.1" and "A.2.2.2.2" this parameter can also be set to different values according to 3GPP TS 36.521-1.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:ALRB on page 517

**Modulation (FRC)**
Displays the modulation for the selected FRC.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:ALRB on page 517

**Payload Size (FRC)**
Displays the payload size for the selected FRC.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:PASize? on page 518

**Physical Bits Per Subframe (Unshortened PUSCH)**
Displays the total number of physical bits available for the PUSCH allocation per subframe, in that unshortened PUSCH is transmitted. Shortened PUSCH transmissions occurs in a cell specific SRS subframe or in subframes where SRS is transmitted.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:TNOBits? on page 519

**Offset VRB (FRC)**
Sets the virtual resource block (VRB) offset for all PUSCH allocation of the selected UE in all subframes.

The VRB Offset set for the individual subframes in the "UL Allocation Table" are overwritten.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:VRBoffset on page 520

**n(2)_DMRS (FRC)**
Sets the UE specific part of the demodulation reference signal (DMRS) index for all PUSCH allocation of the selected UE in all subframes.

The n(2)_DMRS set for the individual subframes in the "Enhanced PUSCH Settings" dialog for the corresponding UE is overwritten.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:N2DMrs` on page 518

### 7.16.3 Realtime Feedback Configuration Settings

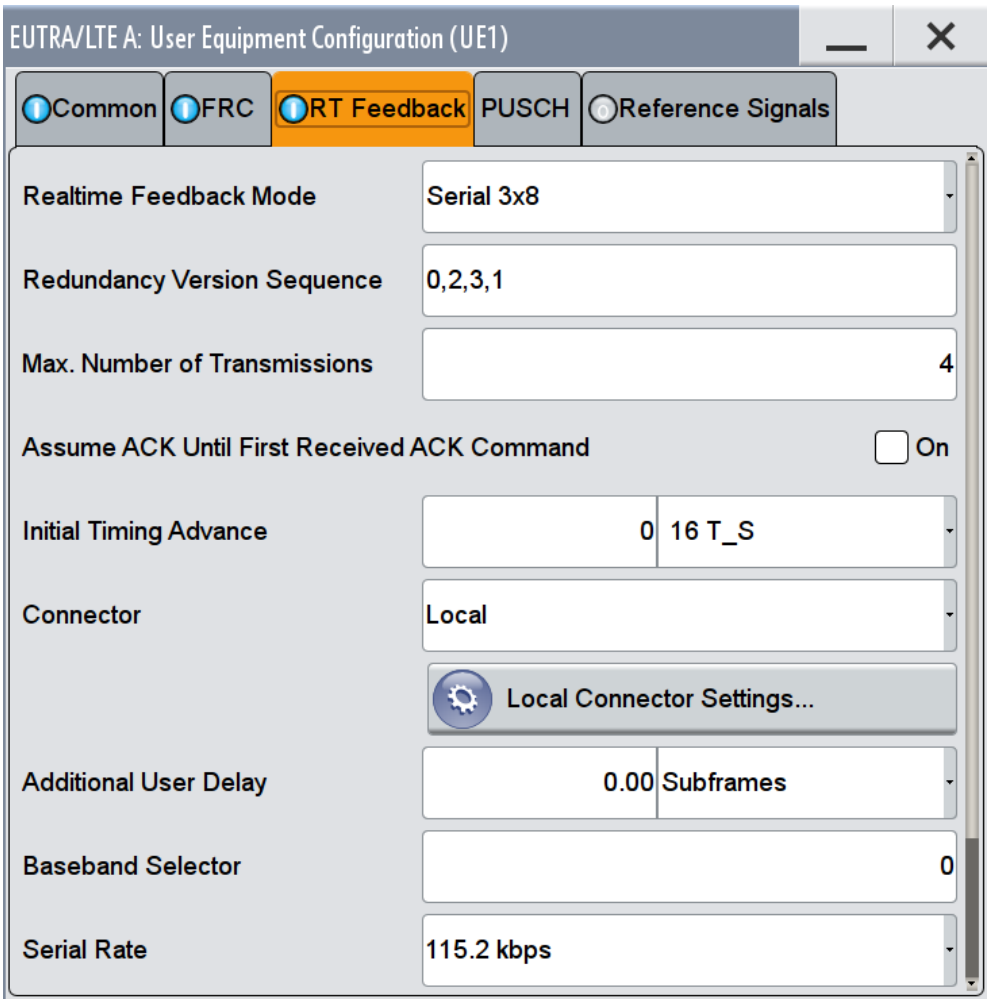
The EUTRA/LTE uplink realtime feedback functionality requires the additional option R&S SMW-K69 Closed Loop BS Tests. This option extends the EUTRA/LTE option R&S SMW-K55 with the possibility to perform closed loop performance tests with feedback as defined in 3GPP TS 36.141, chapter 8.

The Realtime Feedback Configuration is enabled only for UE1 in instruments equipped with the option R&S SMW-K69.

To access the "RT Feedback" dialog,

1. select "General > Link Direction > Uplink (SC-FDMA)"
2. select "Frame Configuration > General > Select User Equipment > UE1... UE4"
3. select "RT Feedback"

4. enable the realtime feedback, i.e. set the realtime "Feedback Mode" to a value different than "Off".




This dialog provides access to the parameters required for generating signals in accordance to the HARQ feedback or UL timing adjustments test cases.

The feedback functionality can be enabled once per baseband block. The user interface and the parameters available for configuration depend on the selected Realtime Feedback Mode. For detailed description of the Realtime Feedback functionality, see chapter 6, "Realtime Feedback for Closed Loop BS Tests", on page 62.

**Realtime Feedback Mode**
Enables realtime feedback and determines the mode (binary or serial).

| | |
|---|---|
| "Off" | Realtime feedback is disabled. |
| "Binary ACK/ NACK" | The ACK/NACK feedback is implemented as low/high voltage level on the feedback line connector.<br>Use the parameter ACK Definition to determine whether a high or a low voltage level represents an ACK.<br>Timing Adjustments Feedback is not supported in this mode. |

"Serial" ACK/NACK Feedback and Timing Adjustments Feedback are implemented by means of a serial protocol (see chapter 6.2.2, "Serial Mode", on page 64).

"Serial 3x8" ACK/NACK Feedback and Timing Adjustments Feedback are implemented by means of a serial commands, consisting of three serial packets (see chapter 6.2.3, "Serial 3x8 Mode", on page 64).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:RTFB:ITADvance` on page 535

**Redundancy Version Sequence**
Determines the sequence of redundancy versions for the individual HARQ processes.

Unless otherwise requested by serial feedback commands, the first value in the sequence of redundancy versions is used each time an ACK is received or for the very first transmission of a process.

The sequence of redundancy versions is read out cyclically, i.e. whenever a NACK is received and a retransmission is requested, the next redundancy version in the sequence is used.

The first value in the sequence is used again even in case a NACK is received, if the Max. Number of Transmissions in a process was reached.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:RTFB:RVSequence` on page 536

**Max. Number of Transmissions**
After this maximum number of transmissions (incl. first transmission), the first redundancy version of the redundancy version sequence is used even in case of NACK.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:RTFB:MAXTrans` on page 535

**Assume ACK until first received ACK command**
("Serial/Serial 3x8" mode only)

If this parameter is enabled, the signal generator will not use any external HARQ feedback from the device under test for its HARQ processes until an ACK command is received the first time. Until that, the generator will behave as if ACK was received for all transmissions - no matter if actually a NACK was received or if no HARQ feedback was received at all. It therefore will not schedule any retransmissions until ACK is received the first time. This functionality can be useful for synchronization purposes (see chapter 6.4, "Avoiding Synchronization Problems", on page 72).

**Note:** This functionality applies independently for every HARQ process, i.e. if this parameter is enabled, an ACK has to be received in every HARQ process first, before the generator stops ignoring any NACKs.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:RTFB:AACK` on page 532

**Initial Timing Advance**
The initial timing advance of the uplink signal (at the output of the instrument's baseband unit) in units of 16 TS.

An initial timing advance greater than zero means that the beginning of the very first subframe of the uplink signal is omitted.

For binary feedback, the timing advance of the uplink signal stays constant (and equal to the initial timing advance) throughout the whole signal output.

The additional timing offset $N_{TA\ offset}$ for TDD, as defined in TS 36.211, is set by the parameter Signal Advance N_TA_offset in the "Trigger/Marker" dialog.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:RTFB:ITADvance` on page 535

**ACK Definition**
("Binary ACK/NACK" mode only)

Determines whether a high or a low binary level on the feedback line connector represents an ACK.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:RTFB:ACKDefinition` on page 532

**Connector**
Determines the feedback line connector, see chapter 6.2, "Feedback Modes", on page 63.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:RTFB:CONNector` on page 534

**Distance Mode**
(Binary ACK/NACK mode only)

Determines how the number of the uplink subframe is calculated, in which the signaled feedback has the desired effect.

See also chapter 6.3.1, "Parameterization of the feedback timing", on page 68.

| | |
|---|---|
| "3GPP" | The uplink subframe in which the signaled feedback has the desired effect is calculated from the downlink subframe number n, in which the feedback was received, according to 3GPP TS 36.213. |
| "Direct Response" | The uplink subframe in which the signaled feedback has the desired effect is calculated from the last sent uplink packet of the HARQ processes. |

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:RTFB:DMODe` on page 535

**Additional User Delay**
Determines the point in time when the feedback can be sent to the instrument.

For more information see chapter 6.3, "Timing Aspects", on page 68.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:RTFB:ADUDelay` on page 533

**Baseband Selector**
("Serial" and "Serial 3x8" mode only)

This parameter is required for multiplexing serial commands for different baseband units to one feedback line. If the selector n is configured in the GUI for a specific baseband unit, the baseband unit will listen only to serial commands containing the selector n.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:RTFB:BBSelector` on page 533

**Serial Rate**
(Serial and Serial 3x8 mode only)

Determines the bit rate of the serial transmission. Possible rates are 115.2 kbps, 1.6 Mbps and 1.92 Mbps.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:RTFB:SERate` on page 537

**Block Error Insertion**
Enables/disables the statistical insertion of block errors into PUSCH packets.

The block error insertion can be enabled for a single HARQ process or for all processes. In the single HARQ process case, the used process is always the one that corresponds to the first activated PUSCH.

If the block error insertion functionality is used, no further impairments should be activated (like "Fading" or "AWGN"), as this would cause the measured block error rate to deviate from the configured block error rate.

If block error insertion is enabled, the generator ignores any externally received HARQ ACK/NACK feedback. Instead, it behaves as if ACK was received for a HARQ process if no block error was generated for the previous transmission of that process and it behaves as if NACK was received for a HARQ process if a block error was generated for the previous transmission of that process.

If a block error is generated in a new transmission, block errors will also be generated in all retransmissions, until the maximum number of transmissions is reached. The reason for this is that otherwise the measured block error rate could deviate from the configured one if for example a non-erroneous retransmission can not be decoded by the device under test if the first transmission (which was erroneous) was impaired too much.

If the block error insertion functionality is used together with the Assume ACK until first received ACK command functionality, no block errors will be inserted before the first received ACK, in order to speed up the synchronization process in this case. This is the only situation where an external HARQ feedback is needed if block error insertion is activated.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:RTFB:BEINsertion` on page 534

**Block Error Rate**
Block error rate for the statistical insertion of block errors.

The block error rate is defined as the ratio from the number of NACKs to the sum of the number of NACKs plus the number of ACKs.

As no external HARQ feedback is taken into account if Block Error Insertion is used, it is expected that the device under test does not send false ACK (ACK after erroneous packet) or false NACK (NACK after non-erroneous packet). Also it is expected that no further impairments like fading or AWGN are applied to the generated uplink signal.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:RTFB:BERate` on page 534

**HARQ Statistics**
Opens the chapter 7.16.4, "HARQ Statistics", on page 235 dialog.

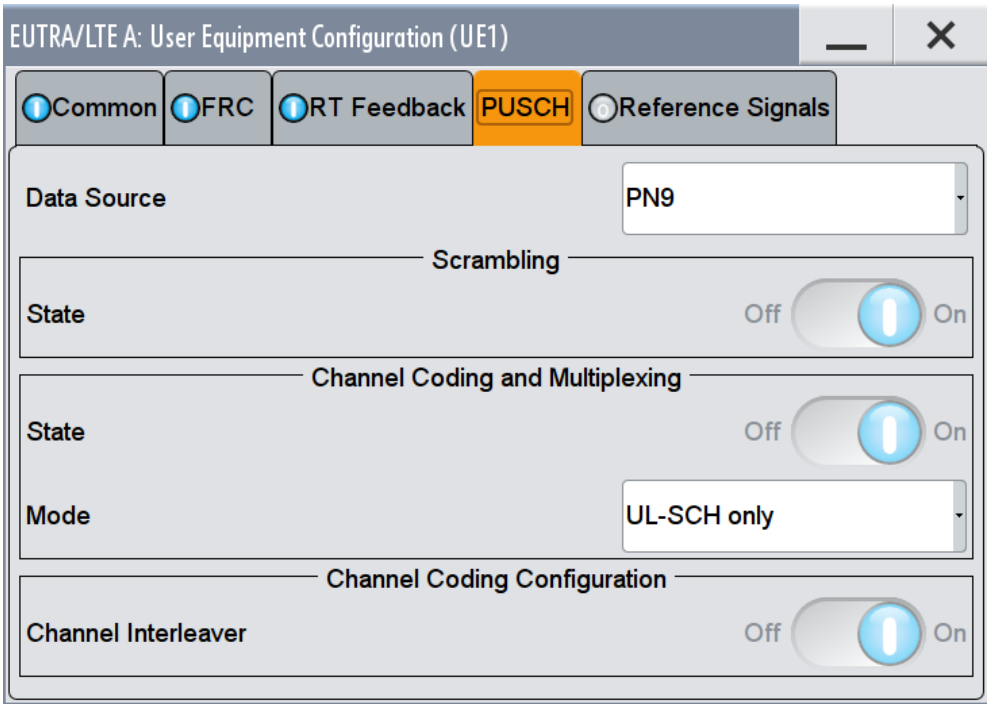
## 7.16.4 HARQ Statistics

This dialog is provided for measuring the HARQ statistics, i.e. the throughput of the uplink transmission. The values of the measured parameters is retrieved from the externally received HARQ feedback commands. The functionality is available in all "Realtime Feedback Modes".

| Parameter | Description | SCPI Command |
|---|---|---|
| "Measurement Period" | Sets the update period of the HARQ statistics measurement. | |
| "Number Of HARQ Processes" | Displays the number of HARQ processes.<br>The value is defined in TS 36.213 and depends on the "Duplexing mode" and on the "UL/DL Configuration". | |
| "Throughput" | Displays the overall absolute throughput of all uplink transmissions that took place during the last measurement period.<br>A "-" represents, that there were no PUSCH transmissions at all (because all subframes are disabled or a PUCCH is transmitted) or if the signal output is not running. | |
| "Percentage Of Maximum Throughput" | Displays the overall relative throughput, for example as required in the TS 36.141 tests.<br>The value "100%" means there were no retransmissions needed at all during the measurement period.<br>The value "0%" means every PUSCH transmission was acknowledged with an NACK during the measurement period.<br>A "-" represents, that there were no PUSCH transmissions at all (because all subframes are disabled or a PUCCH is transmitted) or if the signal output is not running. | |
| "Individual Processes" | Displays the absolute and relative throughputs per individual HARQ process.<br>The number of processes corresponds to the value displayed by the parameter "Number Of HARQ Processes". | |

### 7.16.5 Physical Uplink Shared Channel (PUSCH)

1. To access this dialog, select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > General > Select User Equipment > UE1... UE4"
3. Select "PUSCH"




In this dialog the data source for the PUSCH can be selected and the channel coding can be configured. Use the Enhanced PUSCH Settings dialog to adjust the additional settings for channel coding of the control information and the multiplexing of the data and control information.

**Data Source (PUSCH)**
Selects the data source for the Physical Uplink Shared Channel (PUSCH) allocation of UE.

New data is retrieved from the data source for every subframe where PUSCH is configured, unless the parameter Restart Data, A/N, CQI and RI every subframe is enabled.

"Data lists" can be generated internally in the data editor or externally.

Data lists are selected in the "File Select" window, which is called by means of the "Data List Management" button.

If the "Pattern" data type is used, the bit pattern is defined in the "Pattern" input box. The length is limited to 64 bits.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:DATA` on page 524

**Data Pattern (PUSCH)**
(Available for data source Pattern only)

Displays the bit pattern.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:PATTern` on page 524

**Data List (PUSCH)**
(Available for data source Data List only)

Opens the "Load PUSCH Data List (UE)" window for loading a saved PUSCH data list. The data list of the selected (highlighted) file is loaded by pressing the "Select" button.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:DSELect` on page 524

**State Scrambling (PUSCH)**
Enables/disables scrambling for all PUSCH allocations of the corresponding UE.

This parameter is always enabled, if a predefined FRC is selected.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:SCRambling:STATe` on page 525

**State Channel Coding and Multiplexing (PUSCH)**
Enables/disables channel coding and multiplexing of data and control information for all PUSCH allocations of the corresponding UE.

If this parameter is disabled, the content retrieved from the Data Source is forwarded to the scrambler without any coding processing.

Additional parameters for the encoding of control information can be set in Enhanced PUSCH Settings dialog.

This parameter is always enabled, if a predefined FRC is selected.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:STATe` on page 525

**Mode Channel Coding**
Defines the information transmitted on the PUSCH.

"UCI+UL-SCH" Control information and data is multiplexed into the PUSCH.

"UL-SCH" Only data is transmitted on PUSCH.

"UCI only" Only uplink control information is transmitted on PUSCH.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:MODE` on page 525

**I_HARQ_offset**
Sets the HARQ-ACK offset index for control information MCS offset determination according to 3GPP TS 36.213, chapter 8.6.3.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:IHARqoffset`
on page 527

**I_RI_offset**
Sets the RI offset index for control information MCS offset determination according to 3GPP TS 36.213, chapter 8.6.3.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:IRIoffset`
on page 527

**I_CQI_offset**
Sets the CQI offset index for control information MCS offset determination according to 3GPP TS 36.213, chapter 8.6.3.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:ICQioffset`
on page 526

**O_CQI-MIN**
Sets the parameter O-CQI minimum

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:OCQimin` on page 527

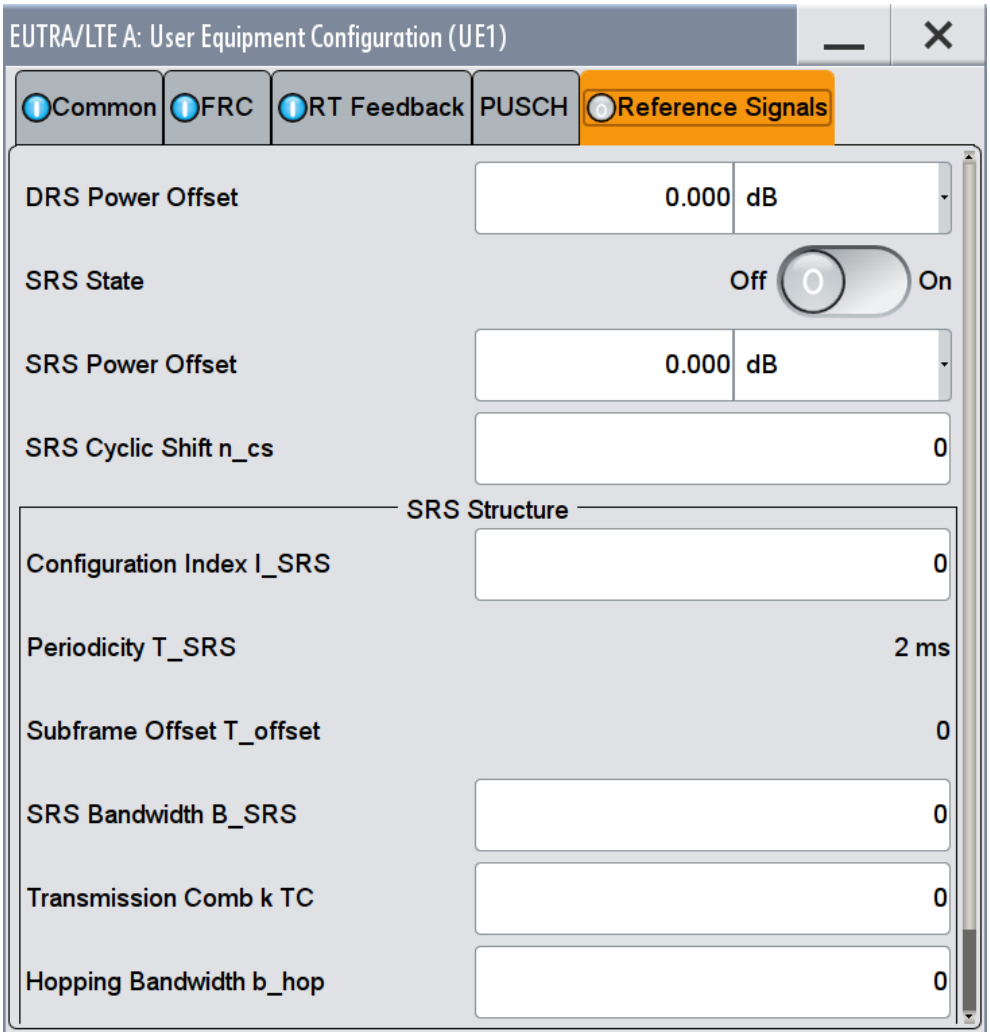
**Channel Interleaver (PUSCH)**
Enables/disables channel interleaving.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:INTerleaver`
on page 526

### 7.16.6 Reference Signal Structure

1. To access this dialog, select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > General > Select User Equipment > UE1... UE4".

3. Select "Reference Signals".




In this dialog the reference signal structure can be configured individually for demodulation and sounding purposes. In the "SRS Structure" section, the UE specific sounding reference signal parameters according to 3GPP TS 36.213 and 3GPP TS 36.211 are enabled for configuration.

The cell specific parameters, necessary for the complete definition of the SRS structure and SRS mapping, are configurable in the General UL Settings dialog.

To visualize the SRS transmission, use the SC-FDMA time plan.

**DRS Power Offset**
Sets the power offset of the Demodulation Reference Signal (DRS) relative to the power level of the PUSCH or PUCCH allocation of the corresponding subframe.

The selected DRS power offset ($P_{DRS\_Offset}$) applies for all subframes.

Depending on the allocation of the subframe, the effective power level of the DRS is calculated as following:

- for PUSCH allocation

$P_{DRS}=P_{UE}+P_{PUSCH}+P_{DRS\_Offset}$

- for PUCCH allocation
  $P_{DRS}=P_{UE}+P_{PUCCH}+P_{DRS\_Offset}$

The PUSCH and PUCCH Power levels ($P_{PUSCH}$ and $P_{PUCCH}$) can vary per subframe.

For global adjustment of the transmit power of the corresponding UE, use the parameter UE Power ($P_{UE}$).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:DRS:POWoffset` on page 528

**SRS State**
Enables/disables sending of SRS for the corresponding UE.

In the symbols reserved for SRS transmission, PUSCH is not transmitted.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:STATe` on page 528

**SRS Power Offset**
Sets the power offset of the Sounding Reference Signal (SRS) relative to the power of the corresponding UE.

The selected SRS power offset applies for all subframes.

The effective power level of the SRS is calculated as follow:

$P_{SRS}=P_{UE}+P_{SRS\_Offset}$

For global adjustment of the transmit power of the corresponding UE, use the parameter UE Power ($P_{UE}$).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:POWoffset` on page 528

**SRS Cyclic Shift n_CS**
Sets the cyclic shift n_CS used for the generation of the sounding reference signal CAZAC sequence.

Since the different shifts of the same Zadoff-Chu sequence are orthogonal to each other, applying different SRS cyclic shifts can be used to schedule different users to transmit simultaneously their sounding reference signal.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:CYCShift` on page 529

**Show Signal Structure Configuration Details>>>**
Opens the menu for configuring the sounding reference signal structure.

Remote command:
n.a.

### 7.16.7 SRS Structure

In the "SRS Structure" section, the UE specific sounding reference signal parameters according to 3GPP TS 36.213 and 3GPP TS 36.211 are enabled for configuration.

The cell specific parameters, necessary for the complete definition of the SRS structure and SRS mapping, are configurable in the General UL Settings dialog.

To visualize the SRS transmission, use the SC-FDMA time plan.

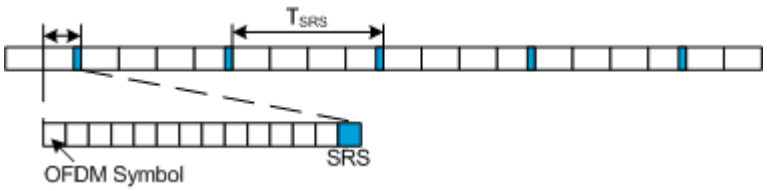
**Configuration Index I_SRS**
Sets the UE specific parameter SRS configuration index $I_{SRS}$. Depending on the selected "Duplexing Mode", this parameter determines the parameters SRS Periodicity T SRS and SRS Subframe Offset T_offset as defined in the 3GPP TS 36.213, Table 8.2-1 (FDD) and 8.2-2 (TDD) respectively.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:ISRS` on page 530

**Periodicity T_SRS**
Displays the UE specific parameter SRS periodicity $T_{SRS}$, i.e. displays the interval of milliseconds after which the SRS is transmitted. The displayed value depends on the selected SRS Configuration Index I_SRS and "Duplexing Mode" as defined in the 3GPP TS 36.213, Table 8.2-1 (FDD) and 8.2-2 (TDD) respectively.

Adjust the SRS configuration index to enable more frequent SRS transmission like each 2 ms or an infrequently SRS transmission like each 320 ms for instance.

For TDD duplexing mode, a T_SRS of 2 ms means that SRS is transmitted two times in 5 ms.



**Example:**

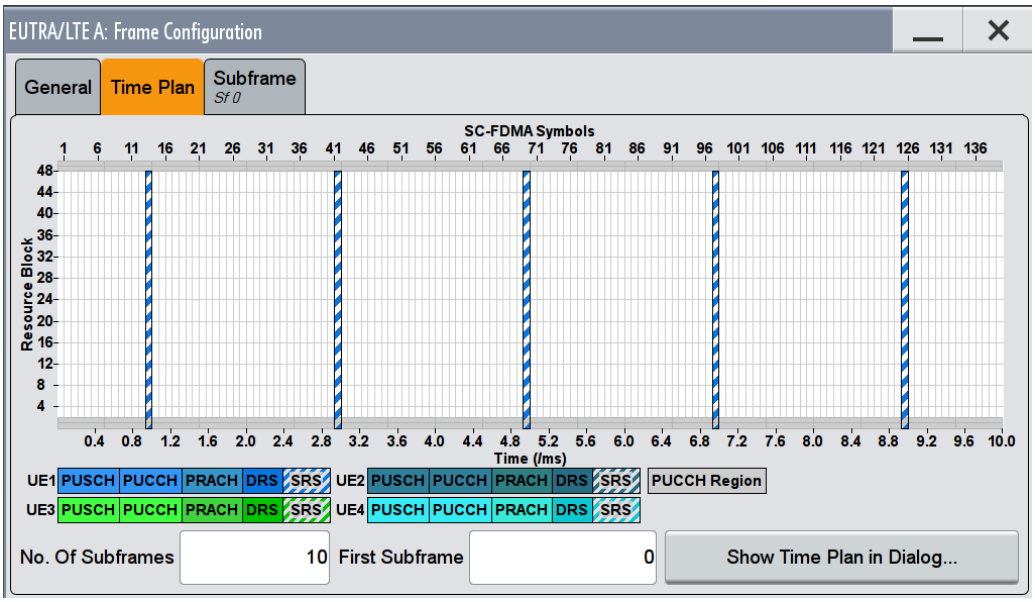
"Configuration Index" = *0*, i.e. "Periodicity T_SRS" = *2 ms* and "Subframe Offset T_offset " = *0*

"SRS State" = *On*

"Duplexing" = *FDD*

The default values of all other SRS parameters are left unchanged.

The SRS is transmitted every 2 ms and occupies the entire channel bandwidth, i.e. frequency hopping is not enabled.



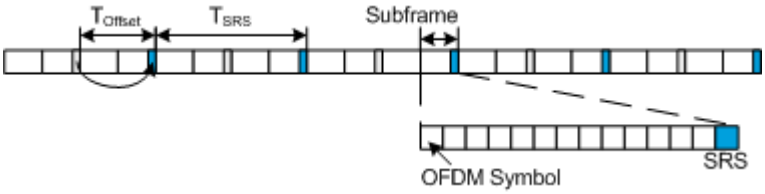

Remote command:

`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:TSRS` on page 530

**Subframe Offset T_offset**

Displays the UE specific parameter SRS subframe offset $T_{offset}$, depending on the selected SRS Configuration Index I_SRS and "Duplexing Mode" as defined in the 3GPP TS 36.213, Table 8.2-1 (FDD) and 8.2-2 (TDD) respectively.

A SRS subframe offset shifts the SRS pattern, i.e. while SRS periodicity T_SRS remains constant, the SRS transmission is delayed with period of time equal to the SRS subframe offset T_offset.



**Example:**

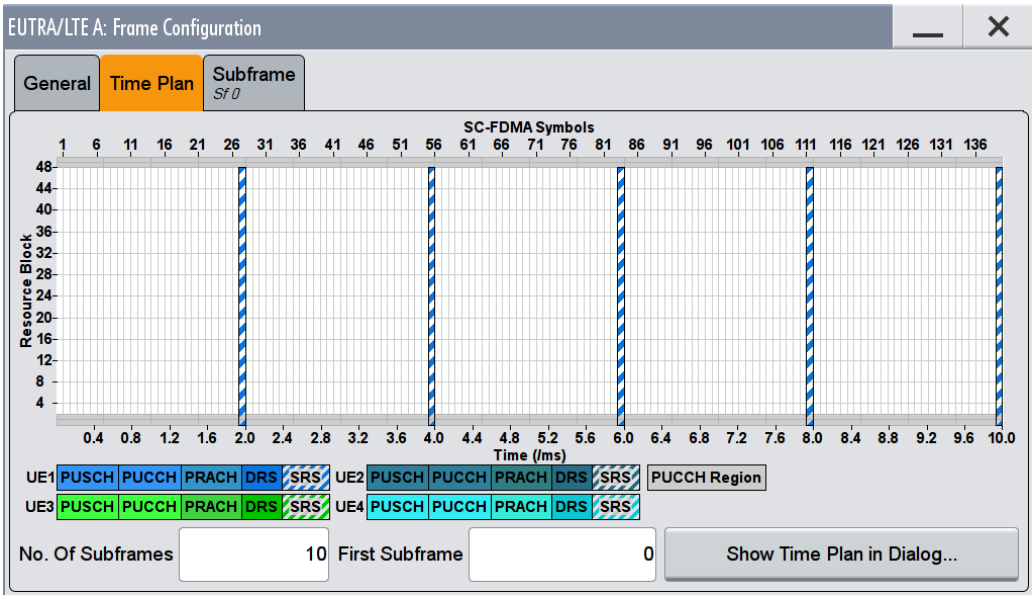
"Configuration Index" = *1*, i.e. "Periodicity T_SRS" = *2 ms* and "Subframe Offset T_offset" = *1*

"SRS State" = *On*

"Duplexing" = *FDD*

The default values of all other SRS parameters are left unchanged.

The SRS is transmitted every 2 ms and occupies the entire channel bandwidth, i.e. frequency hopping is not enabled. Compared to the SRS transmission with $T_{offset}$ = 0, the SRS transmission is delayed with 1 ms.




For TDD duplexing mode, a T_offset of 0 or 5 means that SRS is transmitted in the second last symbol of the special subframe (in the UpPTS part). For this cases, adjust the parameter Configuration of Special Subframes so that an UpPTS field length of two symbols is assured.

For TDD duplexing mode with T_SRS value of 2 ms, two T_offset values are displayed, corresponding to the two SRS transmissions per 5 ms. For example, the values 0,1 mean that two SRS transmissions occur, both in the special subframe. One of them is in the second last symbol and the other one, in the last symbol of the subframe.

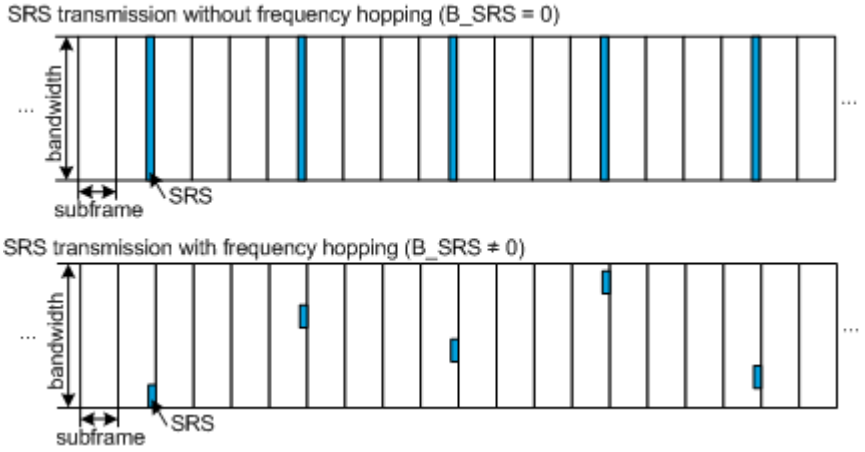
Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:TOFFset?` on page 530

**SRS Bandwidth B_SRS**

Sets the UE specific parameter SRS Bandwidth $B_{SRS}$, as defined in the 3GPP TS 36.211, chapter 5.5.3.2.

The SRS can span the entire frequency bandwidth or can employ frequency hopping where several narrowband SRSs cover the same total bandwidth.

There are up to four SRS bandwidths defined in the standard. The most narrow SRS bandwidth (B_SRS = 3) spans four resource blocks and is available for all channel bandwidths; the other three values of the parameter B_SRS define more wideband SRS bandwidths, available depending on the channel bandwidth.




The SRS transmission bandwidth is determined additionally by the "SRS Bandwidth Configuration $C_{SRS}$".

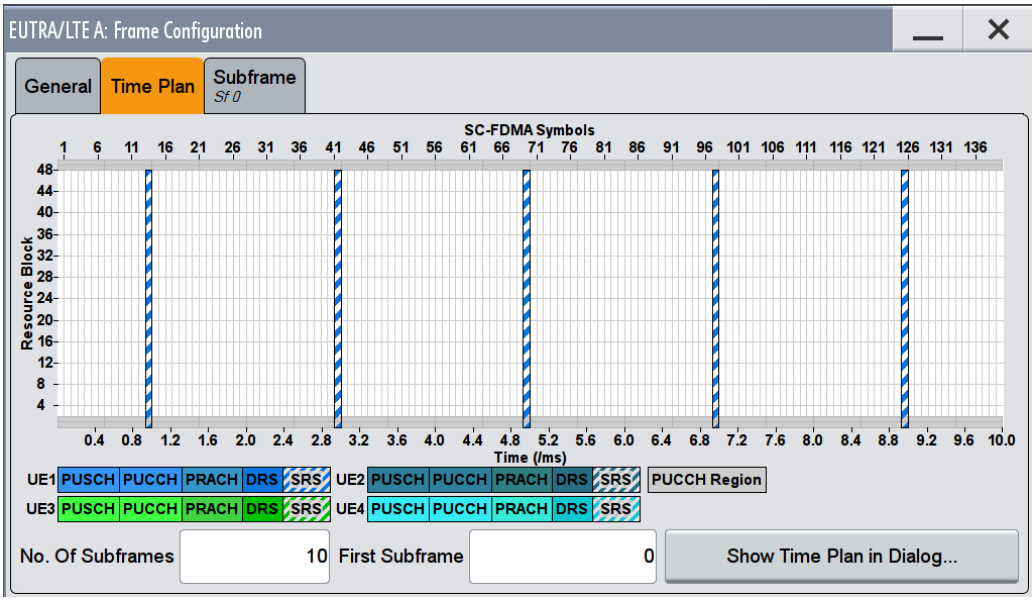
**Example:**

"SRS State" = *On*

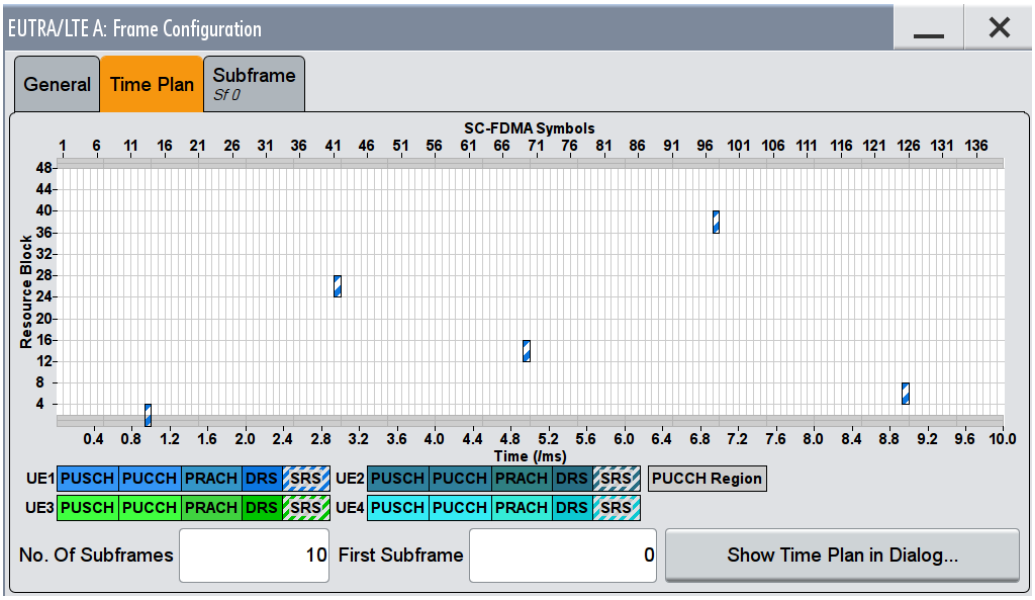
"Duplexing" = *FDD*

The default values of all other SRS parameters are left unchanged.

For B_SRS = 0 the SC-FDMA time plan shows a wideband SRS without frequency hopping.




Changing the SRS bandwidth to "B_SRS" = 3 results in the most narrowband SRS transmission with SRS bandwidth of 4 RBs and enabled frequency hopping.




Remote command:

`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:BSRS` on page 529

**Transmission Comb k TC**
Sets the UE specific parameter transmission comb $k_{TC}$, as defined in the 3GPP TS 36.211, chapter 5.5.3.2.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:TRComb` on page 531

**Hopping Bandwidth b_hop**
Sets the UE specific parameter frequency hopping bandwidth $b_{hop}$, as defined in the 3GPP TS 36.211, chapter 5.5.3.2.

SRS frequency hopping is enabled, if $b_{HOP}<B_{SRS}$.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:BHOP` on page 529

**Freq. Domain Position n_RRC**
Sets the UE specific parameter frqDomainPosition $n_{RRC}$, as defined in the 3GPP TS 36.211, chapter 5.5.3.2.

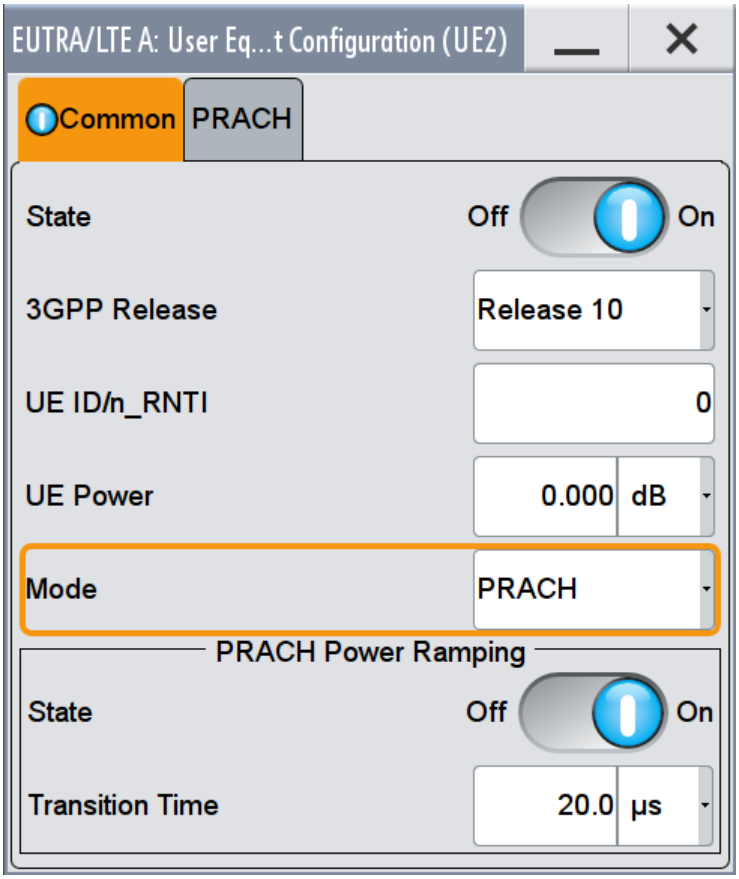
This parameter determines the starting physical resource block of the SRS transmission.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:NRRC` on page 531

### 7.16.8 PRACH Power Ramping

1. To access this dialog, select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > General > Select User Equipment > UE1... UE4"

3. Select "Common > Mode > PRACH"




This dialog comprises the settings needed for configuring the PRACH power ramping.

**State PRACH Power Ramping**
Activates Power Ramping for the PRACH preamble. The start and the end of the preamble is cyclically extended and multiplied with a ramping function (sin^2).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:PRSTate` on page 520

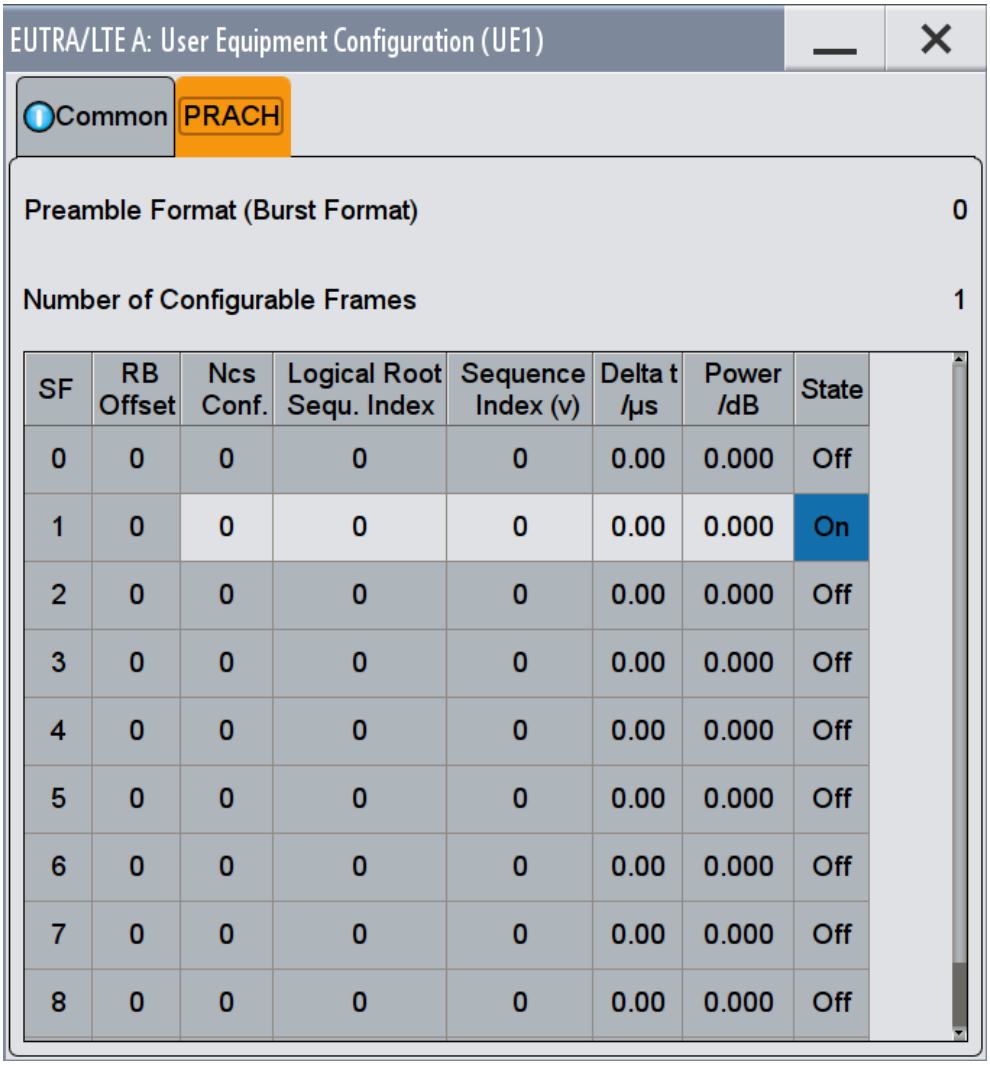
**Transition Time**
Defines the transition time from beginning of the extended preamble to the start of the preamble itself.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:PRTT` on page 520

## 7.16.9 PRACH Configuration

1. To access this dialog, select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > General > Select User Equipment > UE1... UE4"

3. Select "Common > Mode > PRACH"
4. Select "PRACH"


EUTRA/LTE A: User Equipment Configuration (UE1)
Common
PRACH
Preamble Format (Burst Format) 0
Number of Configurable Frames 1
SF RB Offset Ncs Conf. Logical Root Sequ. Index Sequence Index (v) Delta t /µs Power /dB State
0 0 0 0 0 0.00 0.000 Off
1 0 0 0 0 0.00 0.000 On
2 0 0 0 0 0.00 0.000 Off
3 0 0 0 0 0.00 0.000 Off
4 0 0 0 0 0.00 0.000 Off
5 0 0 0 0 0.00 0.000 Off
6 0 0 0 0 0.00 0.000 Off
7 0 0 0 0 0.00 0.000 Off
8 0 0 0 0 0.00 0.000 Off

In this dialog the UE specific parameters according to 3GPP TS 36.211 are enabled for configuration. .

The cell specific parameters, necessary for the complete definition of the PRACH, are configurable in the General UL Settings dialog.

**Preamble Format (Burst Format)**
Displays the preamble format.

The "Preamble Format" is automatically derived form the PRACH Configuration.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:PRFormat` on page 521

**Number of Configurable Frames**
Shows how many frames can be configured.

A maximum number of 20 frames are available for configuration; the currently available number of frames depends on the selected ARB ARB Settings.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:CFRames on page 521

**SF**
Displays the consecutive number of the subframe.

The subframes available for configuration depend on the selected "Duplexing" mode and "PRACH Configuration".

Remote command:
n.a.

**RB Offset**
Displays the starting RB, as set with the parameter PRACH Frequency Offset.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:RBOFfset
on page 521

**Frequency Resource Index**
This parameter is enabled in TDD duplexing mode only.

Sets the frequency resource index $f_{RA}$ for the selected subframe.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:FRINdex
on page 522

**Ncs Configuration**
Selects the Ncs configuration of the selected subframe, i.e. determines the Ncs value for the selected preamble set according to TS 36.211, table 5.7.2.-2 and 5.7.2-3.

The value range of this parameter depends on the selected Duplexing mode, PRACH configuration and whether a restricted preamble set is enabled or not.

| Parameter | Value Range Ncs Configuration |
|---|---|
| Disabled Restricted Set (High Speed Mode) | 0 .. 15 |
| Enabled "Restricted Preamble Set" | 0 .. 14 |
| TDD + PRACH Configuration > 47 | 0 .. 6 |

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:NCSConf
on page 522

**Logical Root Sequence Index**
Selects the logical root sequence index for the selected subframe.

The value range of this parameter depends on the combination of selected Duplexing mode and PRACH configuration.

| Parameter | Value Range Logical Root Sequence Index |
|---|---|
| TDD + PRACH Configuration > 47 i.e. Preamble Format 4 | 0 .. 137 |
| All other cases | 0 .. 837 |

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:RSEQuence
on page 523

**Sequence Index (v)**
Selects the sequence index **v** for the selected subframe, i.e. selects which one of the 64 preambles available in a cell will be used.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:SINDex
on page 523

**Delta t/us**
Sets the parameter Delta_t in us.

A value of delta t different than 0 causes a time shift of the configured preamble.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:DT on page 523

**Power (PRACH)**
Sets the PRACH power relative to the UE power. The PRACH power can be adjusted independently for every configured preamble.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:POWer on page 522

**State (PRACH)**
Enables/disables the PRACH for the selected subframe.

The subframes available for configuration depend on the selected PRACH configuration.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:STATe on page 523

## 7.17 Enhanced PUSCH Settings

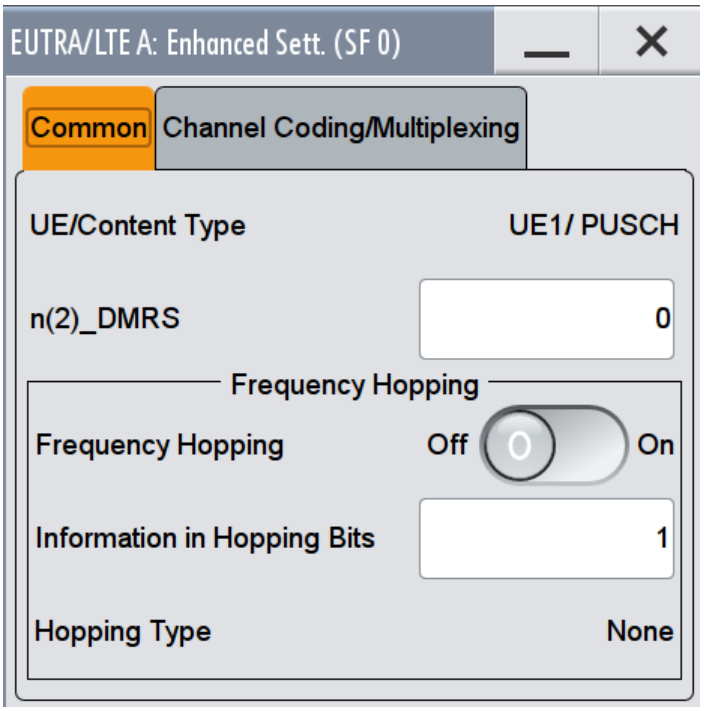
1. To access this dialog, select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > Subframe > Content > PUSCH".

3. Select "Enhanced Settings > Configure".

   This dialog for PUSCH allows you to define and configure additional PUSCH parameters, such as the settings of the uplink shared channel (UL-SCH), HARQ control information and the Channel Quality Control Information (CQI). This dialog provides the possibility to adjust the parameters for channel coding of the control information (HARQ and CQI) and to configure the multiplexing of this control information with the data transmission over the UL-SCH.

### 7.17.1 Common PUSCH Settings

1. To access this dialog, select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > Subframe > Content > PUSCH".
3. Select "Enhanced Settings > Configure > Common".




   This dialog comprises the common settings and the settings needed for configuring the frequency hopping.

Provided are the following settings:

**UE/Content Type**
Displays the UE number and the content type of the selected allocation.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:CONType`
on page 496

**n(2)_DMRS**
Sets the part of the demodulation reference signal (DMRS) index which is part of the uplink scheduling assignment and therefore only valid for the according UE in the according subframe.

This index applies when multiple shifts within a cell are used and is used by the calculation of the DMRS sequence.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:NDMRs` on page 500

## 7.17.2 Frequency Hopping

**Frequency Hopping**
Enables/disables frequency hopping for PUSCH.

Frequency hopping is applied according to 3GPP TS 36.213.

Based on the Information in Hopping Bits, a UE performing PUSCH frequency hopping applies one of the two possible Hopping Type.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:FHOP:STATe` on page 500

**Information in Hopping Bits**
Sets the information in hopping bits according to the PDCCH DCI format 0 hopping bit definition. This information determines whether type 1 or type 2 hopping is used in the subframe, and - in case of type 1 - additionally determines the exact hopping function to use.

Frequency hopping is applied according to 3GPP TS 36.213.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:FHOP:IIHBits` on page 501

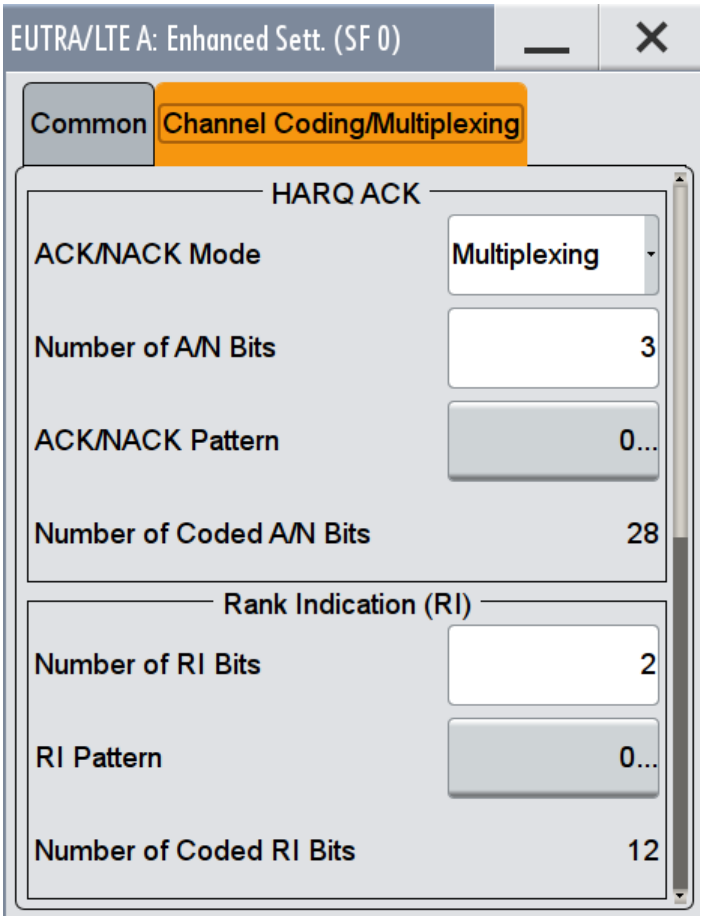
**Hopping Type**
Displays the frequency hopping type used, as defined in 3GPP TS 36.213.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:FHOP:TYPE` on page 501

## 7.17.3 Channel Coding / Multiplexing

1. To access this dialog, select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > General > Select User Equipment > UE1... UE4"

3. Select "PUSCH > Channel Coding and Multiplexing > State > On" (refer to Channel Coding)
4. Select "Mode > UCI+UL-SCH " or "Mode > UCI only" (refer to Mode Channel Coding )
5. Select "Frame Configuration > Subframe > Content > PUSCH"
6. Select "Enhanced Settings > Configure > Channel Coding/Multiplexing"




This dialog provides the possibility to adjust the parameters for channel coding of the control information (HARQ and CQI) and to configure the multiplexing of this control information with the data transmission over the UL-SCH.

**ACK/NACK Mode**
Sets the ACK/NACK mode to Multiplexing or Bundling according to 3GPP TS 36.212, chapter 5.2.2.6.

ACK/NACK Mode Bundling is defined for TDD duplexing mode only and is the only one available mode for UL/DL Configuration 5.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:MODE`
on page 501

**N_bundled**
For "ACK/NACK Mode Bundling", sets the parameter N_bundled according to 3GPP TS36.212, section 5.2.2.6.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:NBUNdled` on page 502

**Number of A/N Bits**
Sets the number of ACK/NACK bits.

Set this parameter to 0 to deactivate the ACK/NACK transmission for the corresponding subframe.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:BITS` on page 502

**ACK/NACK Pattern**
Sets the ACK/NACK bits in form of a 64 bits long pattern.

A "1" indicates an ACK, a "0" - a NACK.

The pattern is read out cyclically and if the pattern is longer than the selected "Number of ACK/NACK Bits", different bits will be transmitted in different subframes using this configuration.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:PATTern` on page 503

**Number of Coded A/N Bits**
Displays the number of coded ACK/NACK bits.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:CBITs` on page 502

**Number of RI Bits**
Sets the number of rank indication (RI) bits.

Set this parameter to 0 to deactivate the RI for the corresponding subframe.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:RI:BITS` on page 504

**RI Pattern**
Sets the RI bits in form of a 64 bits long pattern.

The pattern is read out cyclically and if the pattern is longer than the selected "Number of RI Bits", different bits will be transmitted in different subframes using this configuration.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:RI:PATTern` on page 505

**Number of Coded RI Bits**
Displays the number of coded RI bits.

If a "Channel Coding Mode UCI + UL-SCH" is selected, the Number of Physical Bits for UL-SCH is determinate by the number of coded bits used for CQI and RI transmission.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:RI:CBITs?` on page 504

**Number of CQI Bits**
Sets the number of CQI bits before channel coding.

If a "Channel Coding Mode UCI + UL-SCH" is selected, the Number of Physical Bits for UL-SCH is determinate by the number of coded bits used for CQI and RI transmission.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CQI:BITS` on page 503

**CQI Pattern**
Sets the CQI pattern for the PUSCH.

The pattern is read out cyclically and if the pattern is longer than the selected "Number of CQI Bits", different bits will be transmitted in different subframes using this configuration.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CQI:PATTern` on page 503

**Number of Coded CQI Bits**
Displays the number of coded CQI bits.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CQI:CBITs?` on page 503

**Phys. Bits / Total Number of Physical Bits**
Displays the size of the selected allocation in bits. The value is set automatically according to the current allocation's settings.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PHYSbits?` on page 498
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:PHYSbits?` on page 498
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:PHYSbits?` on page 498

**Number of Coded UL-SCH Bits**
Displays the number of physical bits used for UL-SCH transmission.

If a "Channel Coding Mode UCI + UL-SCH" is selected, the value is calculated as follow:

"Number of Coded UL-SCH Bits" = Total Number of Physical Bits - Number of Coded CQI Bits - Number of Coded RI Bits

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:ULSCh:BITS?` on page 505

**Transport Block Size/Payload (PUSCH)**
Sets the size of the transport block.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CCODing:TBSize` on page 505

**Redundancy Version Index (PUSCH)**
Sets the redundancy version index.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CCODing:RVINdex` on page 506

## 7.18 Enhanced PUCCH Settings

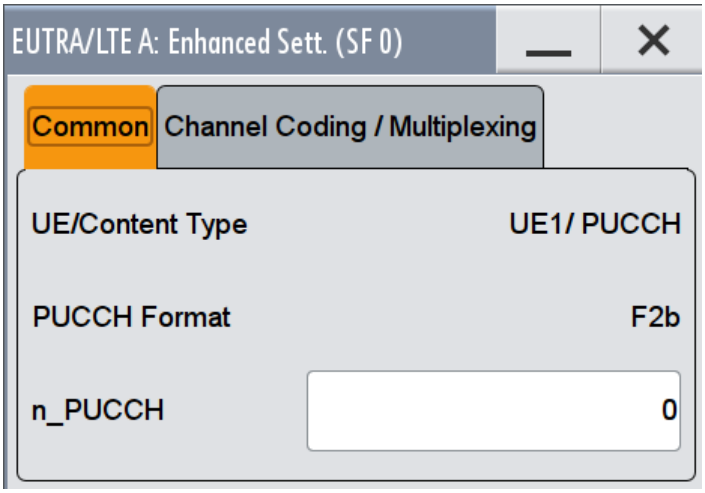
1. To access this dialog, select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > Subframe > Content > PUCCH".
3. Select "Enhanced Settings > Configure".

   This dialog displays the PUCCH relevant settings and allows you to define and configure the PUCCH resource index.

### 7.18.1 Common Settings

1. To access this dialog, select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > Subframe > Content > PUCCH"

3. Select "Enhanced Settings > Configure > Common"




This dialog displays the PUCCH relevant settings and allows you to define and configure the PUCCH resource index.

Provided are the following settings:

**UE/Content Type**
Displays the UE number and the content type of the selected allocation.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:CONType`
on page 496

**PUCCH Format**
Displays the selected PUCCH Format.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:FORMat`
on page 496

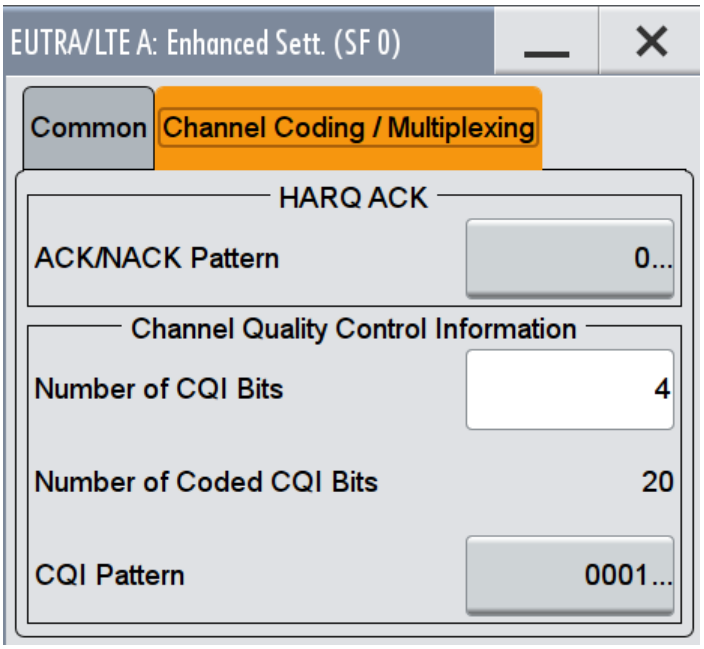
**n_PUCCH**
Sets the resource index for PUCCH format 1/1a/1b respectively 2/2a/2b.

For configuration of multi user PUCCH tests according to 3GPP TS 36.141, annex A9, set the n_PUCCH parameter to the value defined in table A.9-1, column "RS orthogonal cover / ACK/NACK orthogonal cover". The R&S Signal Generator calculates and configures automatically the values defined in the columns "Cyclic shift index" and "Orthogonal cover index".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:NPAR`
on page 506

### 7.18.2 Channel Coding / Multiplexing

1. To access this dialog, select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > Subframe > Content > PUCCH"
3. Select "Enhanced Settings > Configure > Channel Coding/Multiplexing"




This dialog and the parameters available for configuration depend on the selected PUCCH Format for the corresponding allocation. PUCCH Format 1 carries no control information, i.e. the entire "Channel Coding/Multiplexing" section is not displayed. CQI control information is carried only by PUCCH formats 2/2a/2b and the CQI parameters are enabled only if one of these formats is selected.

Provided are the following settings:

**ACK/NACK Pattern / ACK/NACK+SR Pattern**
("ACK/NACK Pattern" is enabled for PUCCH formats 1a/1b, 2a/2b; "ACK/NACK+SR Pattern" for PUCCH format 3)

Use this parameter to set the ACK/NACK pattern for the PUCCH for the selected subframe. A "1" indicates an ACK, a "0" - a NACK

In PUCCH format 3, the bits given by the ACK/NACK+SR PATTERN represent the $o^{ACK}$ bits according to 3GPP TS 36.212, i.e. the up to 21 bits that contain ACK/NACK information for up to two codewords and optionally SR. The number of bits used per subframe is determinate by the value of the parameter "Number of ACK/NACK+SR Bits" on page 260.

To enable the generation of signals with ACK/NACK respectively ACK/NACK+SR information that varies not only per subframe but also differs over the frames, set a pattern with

- more than 1 bit for the PUCCH formats 1a/2a
- more than 2 bits for the PUCCH formats 1b/2b
- more than "Number of ACK/NACK+SR Bits" on page 260 for PUCCH format 3

The ACK/NACK pattern has a maximal length of 32 bits and is read out cyclically.

**Example:**

"Duplexing Mode" = FDD

"Sequence Length" = 4 Frames (`BB:EUTR:SLEN 4`)

"Number of Configurable Subframes" = 8 (`BB:EUTR:UL:CONS 8`)

"PUCCH Format" = 1a or 2a (`BB:EUTR:UL:SUBF0:ALL1:FORM F1A|F2A`)

"ACK/NACK Pattern" = 01001 (`BB:EUTR:UL:SUBF0:ALL1:PUCC:HARQ:PATT #B01001,5`)

The generated signal will carry ACK/NACK information as shown on the figure bellow.

Example: PUCCH Format 1a/2a, ACK/NACK Pattern '01001'

| Subframe | #0 | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 | #9 |
|---|---|---|---|---|---|---|---|---|---|---|
| Frame#1 | ACK/ NACK=0 | | | | | | | | ACK/ NACK=1 | |
| Frame#2 | | | | | | | ACK/ NACK=0 | | | |
| Frame#3 | | | | | ACK/ NACK=0 | | | | | |
| Frame#4 | | | ACK/ NACK=1 | | | | | | | |

By changing only the PUCCH Format to 1b or 2b (`BB:EUTR:UL:SUBF0:ALL1:FORM F1B|F2B`), the ACK/NACK information per subframe will change as shown on the figure bellow.

Example: PUCCH Format 1b/2b, ACK/NACK Pattern '01001'

| Subframe | #0 | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 | #9 |
|---|---|---|---|---|---|---|---|---|---|---|
| Frame#1 | ACK/ NACK=01 | | | | | | | | ACK/ NACK=00 | |
| Frame#2 | | | | | | | ACK/ NACK=10 | | | |
| Frame#3 | | | | | ACK/ NACK=10 | | | | | |
| Frame#4 | | | ACK/ NACK=01 | | | | | | | |

Remote command:

`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:HARQ:PATTern` on page 507

**Number of CQI Bits (PUCCH)**

(enabled for PUCCH formats 2/2a/2b only)

Sets the number of CQI bits before channel coding.

Remote command:

`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CQI:BITS` on page 508

**PUCCH Format 3 Settings**
The PUCCH format 3 is required for sending of the ACK/NACK messages in case DL carrier aggregation with more than two component carriers is used.

See also chapter 3.6, "LTE-Advanced Introduction", on page 39 and chapter 7.10.1, "DL Carrier Aggregation Configuration", on page 107.

**Number of ACK/NACK+SR Bits ← PUCCH Format 3 Settings**
(enabled for PUCCH format 3 only)

Sets the number of ACK/NACK+SR bits before channel coding.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:HARQ:BITS` on page 506

**Number of Coded ACK/NACK+SR Bits ← PUCCH Format 3 Settings**
(enabled for PUCCH format 3 only)

Displays the number of coded ACK/NACK+SR bits.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:HARQ:CBITs?` on page 506

**ACK/NACK+SR Pattern ← PUCCH Format 3 Settings**
(enabled for PUCCH format 3 only)

See "ACK/NACK Pattern / ACK/NACK+SR Pattern" on page 258.

**Number of Coded CQI Bits (PUCCH)**
Displays the number of coded CQI bits.

The number of coded CQI bits for PUCCH is always 20.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CQI:CBITs?` on page 507

**CQI Pattern (PUCCH)**
Sets the CQI pattern for the PUCCH.

The length of the pattern is determinate by the value of the parameter Number of CQI Bits.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CQI:PATTern` on page 508

## 7.19 TDD Timeplan

1. To access this dialog, select "General > Duplexing > TDD".

2. Select "Frame Configuration > Time Plan"

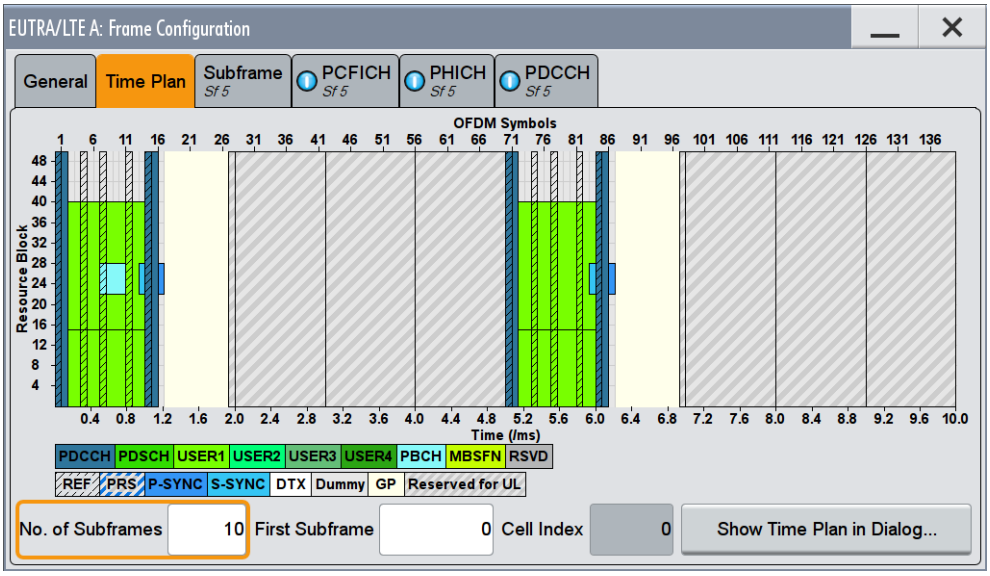



*Fig. 7-13: TDD time plan (DL)*

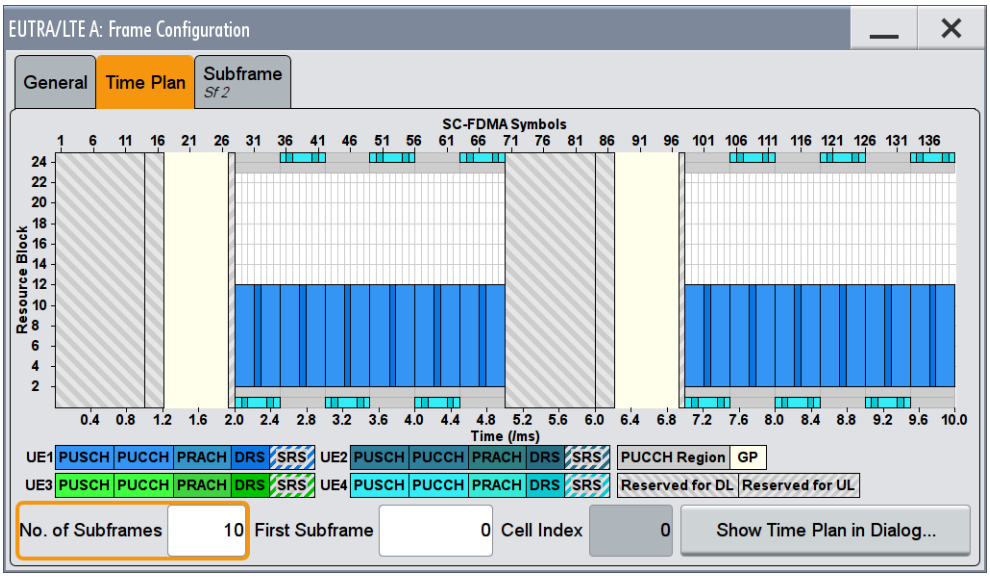



*Fig. 7-14: TDD time plan (UL)*

This dialog shows the time plan for "Duplexing Mode > TDD".

The x-axis shows allocation in the time domain. The y-axis shows the resource blocks as smallest allocation granularity in the frequency domain.

The frame structure of depends on the selected "DL/UL Configuration" and the "Configuration of Special Subframe".

**First Subframe**
Selects the first subframe to be displayed.

Remote command:
n.a.

**No. of Subframes**
Selects the number of subframes to be displayed.

Remote command:
n.a.

**Show Time Plan in Dialog**
Enlarges the time plan display.

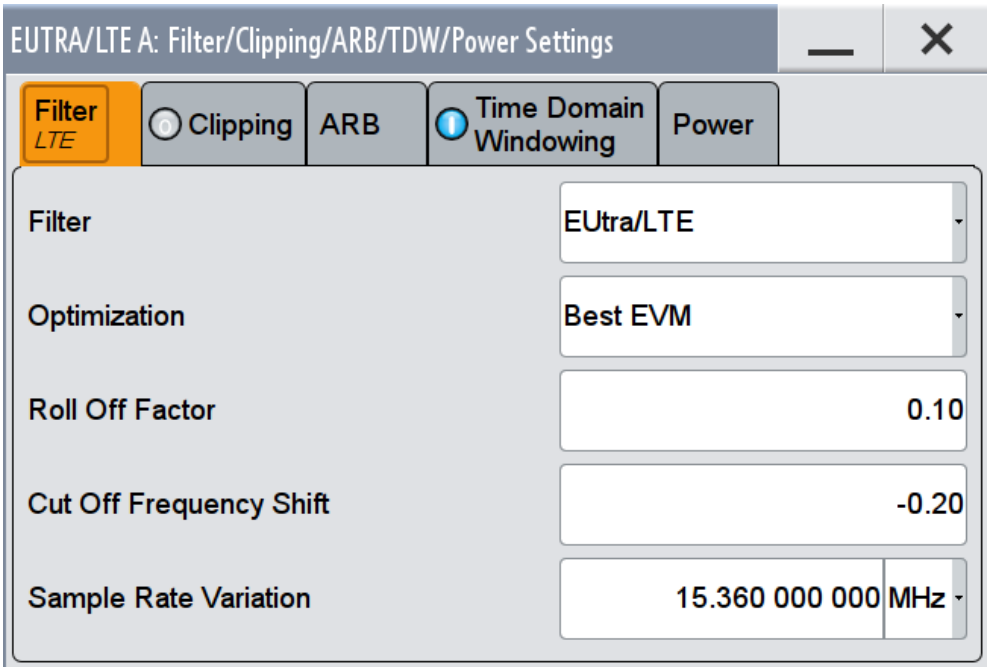
## 7.20 Filter/Clipping/Power Settings

► To access this dialog, select "EUTRA/LTE > General > Filter/Clipping/ARB/TDW/ Power Settings".

The dialog comprises the settings, necessary to enable time domain windowing and clipping, to adjust the baseband filter and power settings.

### 7.20.1 Filter Settings

► To access this dialog, select "Filter".



This dialog comprises the settings required for configuring the baseband filter.

Provided are the follwoing settings for configuring the baseband filter:

**Filter**
Sets the baseband filter.

Remote command:
[:SOURce<hw>]:BB:EUTRa:FILTer:TYPE on page 374

**Optimization**
Selects one of the provided EUTRA/LTE filters.

Each filter is designed for different application field and optimized for a particular performance. Depending on the filter implementation, these filters require different calculation time. The applied upsampling factor also influences the size of the calculated output waveform file. An output waveform is calculated with the "Generate Waveform File" function or by generating of an LTE waveform with R&S WinIQSIM2.

The following table outlines the difference between the provided EUTRA/LTE filters by comparing their major specifications.

*Table 7-14: Overview of the EUTRA/LTE filters*

| **Characteristic** | **"Best EVM"** | **"Best APC"**<br>**"Best ACP (Narrow)"** | **"Best EVM (no upsampling)"** |
|---|---|---|---|
| **Design goal** | An excellent EVM performance while ignoring the effects on ACP | A combination of an excellent ACP performance and a good EVM performance<br>"Best ACP (Narrow)" features additionally a smoother shape in frequency domain | A combination of an excellent ACP performance and a good EVM performance<br>small output waveform file size |
| **Calculation time** (in real-time processing) | By real-time processing, short calculation time | Long calculation time: the filtered signal is precalculated because of the filter complexity | Long calculation time: the filtered signal is precalculated because of the filter complexity |
| **Upsampling** | Upsampling with factor 2<br>The sample rate of the output waveform is twice the LTE sample rate | Upsampling with factor 2<br>The sample rate of the output waveform is twice the LTE sample rate<br>The signal processing requires twice as much internal memory and the available memory on the instrument is sufficient for the simulation of half as much frames compared to filter "Best EVM" | Upsampling is not applied<br>The sample rate of the output waveform is not changed |
| **Output waveform file size** | Increased file size | Increased file size | File size is maintained<br>The resulting file size is smaller than in the other cases |
| **Recommended application field** | Receiver and performance tests with internal real-time generation, where BLER is analyzed | Transmitter and components tests where excellent ACP is required | Receiver and performance tests with pre-generated waveform files, where BLER is analyzed |

Remote command:
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LTE:OPTimization
on page 376

**Load User Filter**
(available for Filter Type user only)

Calls the menu "Select List File User Filter" for selecting a user-defined filter file with extension `*.vaf`.

For more information, refer to the description "Introduction to "filtwiz" Filter Editor" on the Rohde&Schwarz Internet page.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:USER` on page 378

**Roll Off Factor or BxT**
Sets the filter parameter.

The Roll Off Factor affects the steepness of the filter flanks. A "Roll Off Factor" = 0 results in the steepest flanks; values near to 1 make the flanks more flat.

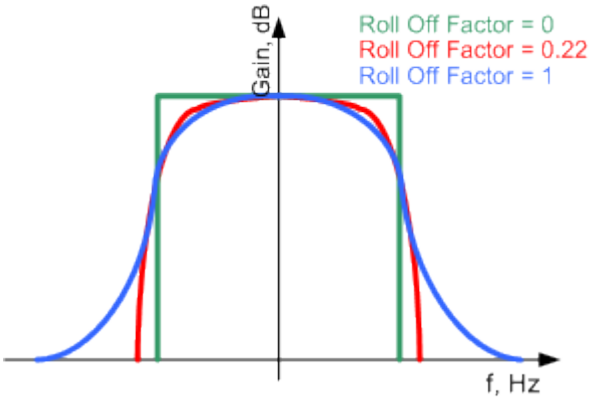



*Fig. 7-15: Example of the frequency response of a filter with different Roll Off Factors*

For the default cosine filter, a roll off factor of 0.10 is used.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:COSine` on page 374
`[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:RCOSine` on page 377
`[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:PGAuss` on page 377
`[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:GAUSs` on page 375
`[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:SPHase` on page 378
`[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:APCO25` on page 374
`[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LTE:ROFactor` on page 377

**Cut Off Frequency Shift**
(available for filter parameter Cosine and EUTRA/LTE with EVM Optimization only)

The cut off frequency is a filter characteristic that defines the frequency at the 3 dB down point. The "Cut Off Frequency Shift" affects this frequency in the way that the filter flanks are "moved" and the transition band increases by "Cut Off Frequency Shift"*"Sample Rate".

- A "Cut Off Frequency Shift" = -1 results in a very narrow-band filter
- Increasing the value up to 1 makes the filter more broad-band
- By "Cut Off Frequency Shift" = 0, the -3 dB point is at the frequency determined by the half of the selected "Sample Rate".

**Tip:** Use this parameter to adjust the cut off frequency and reach spectrum mask requirements.

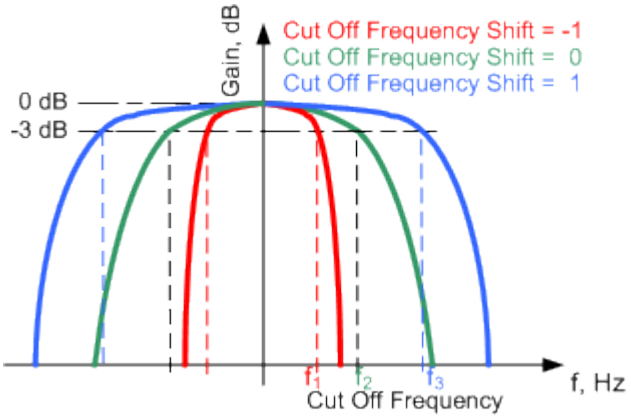



*Fig. 7-16: Example of the frequency response of a filter with different Cut Off Frequency Shift*

**Example:**

"Channel Bandwidth" = 10 MHz

"Sample Rate" = 15.36 MHz

"Cut Off Frequency Shift" = 0

Frequency at 3 dB down point = +/- 7.68 MHz

Remote command:

`[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:COSine:COFS` on page 375

`[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LTE:COFS` on page 376

**Cut Off Frequency Factor**

(available for filter parameter Lowpass and EUTRA/LTE with ACP Optimization only)

Sets the value for the cut off frequency factor. The cut off frequency of the filter can be adjusted to reach spectrum mask requirements.

Remote command:

`[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LPASs` on page 375

`[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LTE:COFFactor` on page 376

`[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LPASSEVM` on page 376

**Filter Mode**

Selects an offline or realtime filter mode.

Remote command:

`[:SOURce<hw>]:BB:EUTRa:FILTer:MODE` on page 374

**Sample Rate Variation**

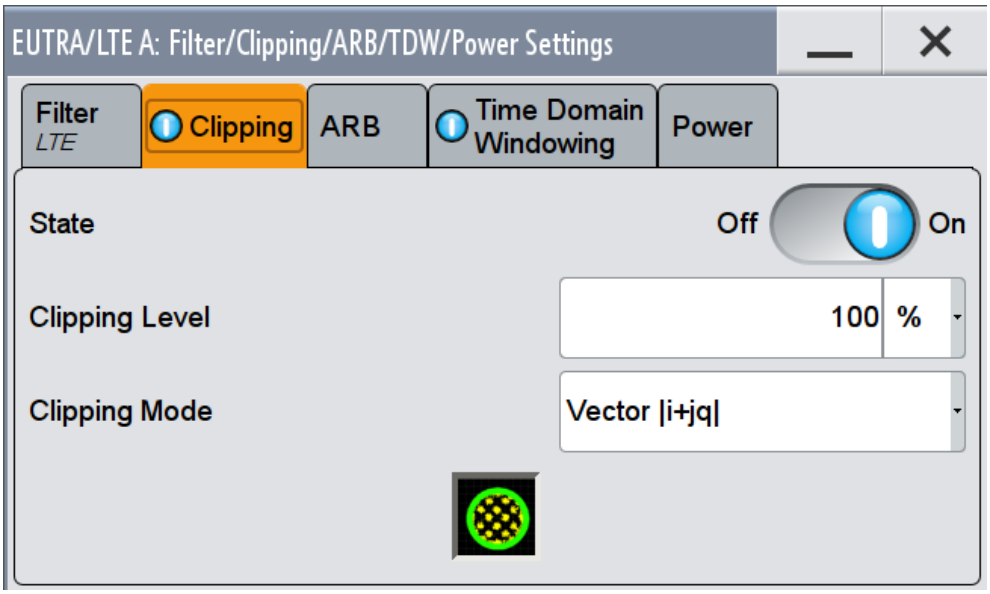
Sets the sample rate of the signal. A variation of this parameter only affects the ARB clock rate; all other signal parameters remain unchanged.

If the sampling rate in the "General Settings" menu is changed, this parameter is reset to the chosen sampling rate.

Remote command:
[:SOURce<hw>]:BB:EUTRa:SRATe:VARiation on page 378

## 7.20.2 Clipping Settings

► To access this dialog, select "Clipping".




This dialog comprises the settings required for configuring the clipping.

Provided are the following settings:

**Clipping State**
Switches baseband clipping on and off.

Baseband clipping is a very simple and effective way of reducing the crest factor of the signal. Since clipping is done prior to filtering, the procedure does not influence the spectrum. The EVM however increases.

Remote command:
[:SOURce<hw>]:BB:EUTRa:CLIPping:STATe on page 380

**Clipping Level**
Sets the limit for clipping.

This value indicates at what point the signal is clipped. It is specified as a percentage, relative to the highest level. 100% indicates that clipping does not take place.

Remote command:
[:SOURce<hw>]:BB:EUTRa:CLIPping:LEVel on page 379

**Clipping Mode**
Selects the clipping method. A graphic illustration of the way in which these two methods work is given in the dialog.

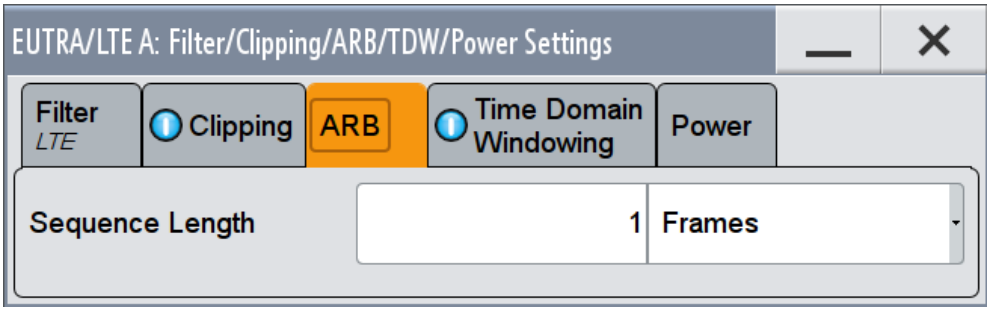
- "Vector | i + q |"
  The limit is related to the amplitude | i + q |. The I and Q components are mapped together, the angle is retained.
- "Scalar | i | + | q |"
  The limit is related to the absolute maximum of all the I and Q values | i | + | q | . The I and Q components are mapped separately, the angle changes.

Selects the clipping method. A graphic illustration of the way in which these two methods work is given in the menu.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:CLIPping:MODE` on page 379

## 7.20.3 ARB Settings

► To access this dialog, select "ARB".




This dialog comprises the settings required for configuring the arbitrary waveform.

Provided are the follwoing settings:

**Sequence Length ARB**
Sets the sequence length of the signal in number of frames. One frame corresponds to 10 ms. The signal is calculated in advance and output in the arbitrary waveform generator. The maximum number of frames is calculated as follows:

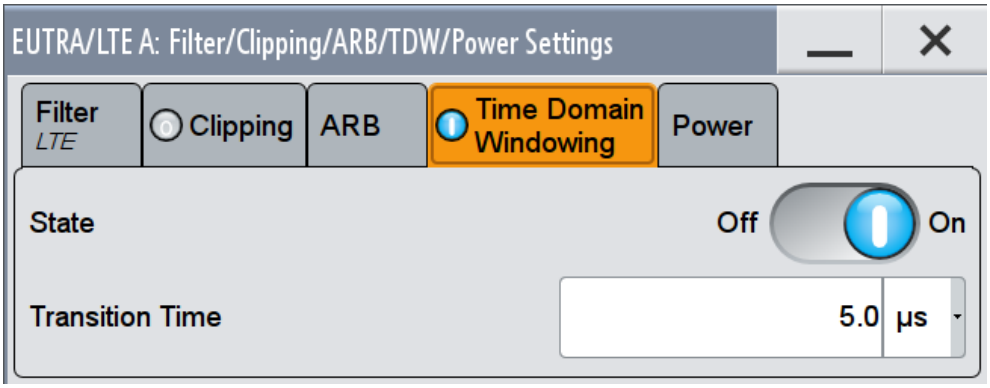
Max. No. of Frames = Arbitrary waveform memory size/("Sampling Rate" x 10 ms).

If the Realtime Feedback functionality is enabled, the signal of UE1 does not depend on the sequence length, because this signal is not calculated in advance. The configuration of the sequence length is then only required, if also the signal of UE2, UE3 or UE4 is used.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:SLENgth` on page 372

### 7.20.4 Time Domain Windowing Settings

► To access this dialog, select "Time Domain Windowing".




This dialog comprises the settings required for configuring the time domain windowing.

Provided are the following settings:

**State (Time Domain Windowing)**
Activates/deactivates the time domain windowing.

Time domain windowing is a method to influence the spectral characteristics (i.e. it removes the spikes caused by the OFDM) of the signal, which is not stipulated by the standard.

However, it does not replace oversampling and subsequent signal filtering.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TDW:STATe` on page 380

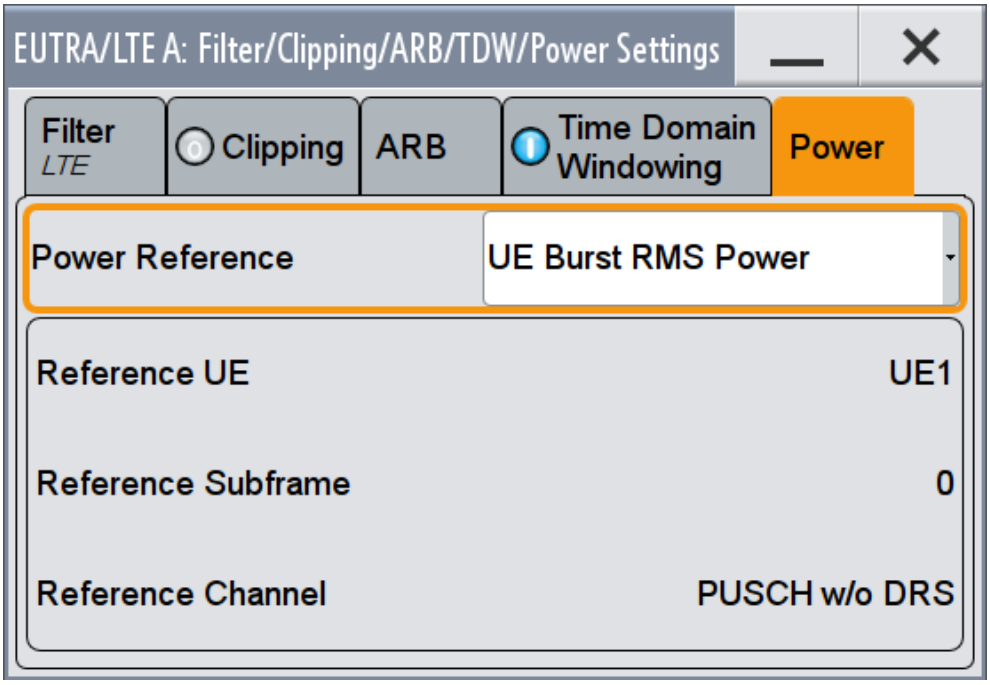
**Transition Time**
Sets the transition time when time domain windowing is active.

The transition time defines the overlap range of two OFDM symbols. At a setting of 1 us and if sample rate = 15.36 MHz, 15 samples overlap.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TDW:TRTime` on page 380

### 7.20.5 Power Settings

► To access this dialog, select "Power".




This dialog comprises the settings required for configuring the the global power level of the generated LTE signal..

For an overview of the provided power settings and a detailed information on how to adjust them, refer to chapter 5.3, "Power Setting", on page 59.

**Power Reference**
Defines the reference the "Level" display in the status bar is referring to.

| | |
|---|---|
| "Frame RMS Power" | The displayed RMS and PEP are measured during the whole frame.<br>All frames are considered, not only the first one. |
| "DL Part of Frame RMS Power" | The displayed RMS and PEP are measured during the DL part of the frame (all DL subframes and the DwPTS).<br>All frames are considered, not only the first one. |
| "UL Part of Frame RMS Power" | The displayed RMS and PEP are measured during the UL part of the frame (all UL subframes and the UpPTS).<br>All frames are considered, not only the first one. |

"UE Burst RMS Power" The displayed RMS and PEP are measured during a single subframe of a certain UE. One of the following channels is used:

- PUSCH (without DRS)
- PUCCH (without DRS)
- PUCCH and PUSCH (both without DRS)
- PRACH or
- SRS.

The subframe, channel and reference used are displayed by means of the parameters Reference Subframe, Reference Channel and Reference UE.

The instrument selects a suitable reference automatically according the following algorithm:

- The first active UE is used
- The data part of the first PUSCH/PUCCH is used
- In PRACH mode, the first PRACH preamble is used
- If there is no active subframe, the SRS is used.

This power mode is required for setting the AWGN correctly (e.g. according to TS 36.141), in case not every possible subframe is used by the simulated UE. The actual part of the signal used for determining RMS and PEP are displayed in the graphical interface.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:POWC:LEVReference` on page 381

**Reference UE**
(enabled for Power Reference set to "UL Burst RMS Power")

Displays the UE the measured RMS and PEP is referring to.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:POWC:RUE?` on page 382

**Reference Subframe**
(enabled for Power Reference set to "UL Burst RMS Power")

Displays the subframe the measured RMS and PEP is referring to.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:POWC:REFSubframe?` on page 381

**Reference Channel**
(enabled for Power Reference set to "UL Burst RMS Power")

Displays the channel type the measured RMS and PEP is referring to.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:POWC:REFChannel` on page 381

# 8 Test Case Wizard

The "Test Case Wizard" supports tests on base stations in conformance with the 3GPP specification for Base Station conformance testing. It offers a selection of predefined settings according to Test Cases in TS 36.141. For an overview of the test cases covered by the test case wizard, refer to chapter 8.3, "Supported Test Cases", on page 273.

With the "Test Case Wizard", it is possible to create highly complex test scenarios with just a few keystrokes.

The "Test Case Wizard" has effect on frequency and level settings, link direction, filter, trigger, baseband clock source, marker settings and base station or user equipment configuration. Besides the EUTRA/LTE required settings also interfering signals (AWGN, CW interferer, co-located modulation signals) or fading profiles are set.

The test setups and the hardcopies in this description assume a fully equipped R&S SMW.

## 8.1 Introduction to Conformance Testing

The main purpose of the conformance testing is to ensure that the base station (BS) and the user equipment (UE) are fulfilling a defined level of minimum performance.

The 3GPP organization defines three groups of conformance testing for the UE: Radio Frequency (RF), Radio Resource Management (RRM) and Signaling. There is only one group conformance testing for the BS, the RF conformance tests.

This chapter is intended to give an overview of the 3GPP test specifications dealing with the conformance tests. Only a brief description is provided.

### 8.1.1 UE Conformance Testing

The UE conformance tests are not in the scope of this description.

**UE RF FDD/TDD Conformance Test Specifications**

The UE RF conformance tests are based on the core specification TS 36.101 and are defined in the TS 36.521. The following list gives an overview of the related specifications:

- TS 36.124 "ElectroMagnetic Compatibility (EMC) requirements for mobile terminals and ancillary equipment"
- TS 36.521-1 "User Equipment (UE) conformance specification; Radio transmission and reception; Part 1: Conformance testing"
  Overview of the test cases:
  – Subclause 6: UE RF transmitter test cases

Transmit power, Output power dynamics, Transmit signal quality, Output RF spectrum emissions and Transmit intermodulation

- Subclause 7: UE RF receiver test cases
  Diversity characteristics, Reference sensitivity power level, Maximum input level, Adjacent Channel Selectivity (ACS), In-band blocking, Out-of-band blocking, Narrow band blocking, Spurious response, Intermodulation characteristics, Spurious emissions
- Subclause 8: UE RF FDD/TDD performance test cases
  Demodulation of PDSCH (Cell-Specific Reference Symbols), Demodulation of PDSCH (User-Specific Reference Symbols), Demodulation of PDCCH/PCFICH, Demodulation of PHICH, Demodulation of PBCH

- TS 36.521-2 "User Equipment (UE) conformance specification; Radio transmission and reception; Part 2: Implementation Conformance Statement (ICS)"
- TS 36.521-3 "User Equipment (UE) conformance specification; Radio transmission and reception; Part 3: Radio Resource Management (RRM) conformance testing"

**UE RRM Conformance Test Specifications**

The following specifications deal with UE RRM conformance testing:

- TS 36.133 "Requirements for support of radio resource management"
- TS 36.521-3 "User Equipment (UE) conformance specification; Part 3: Test suites"

**UE Signaling Conformance Test Specifications**

The UE signaling conformance tests are defined in the TS 36.523.

- TS 36.523-1 "User Equipment (UE) conformance specification; Part 1: Protocol conformance specification"
- TS 36.523-2 "User Equipment (UE) conformance specification; Part 2: Implementation Conformance Statement (ICS) proforma specification"
- TS 36.523-3 "User Equipment (UE) conformance specification; Part 3: Test suites"

### 8.1.2 BS Conformance Testing

**BS RF FDD/TDD Conformance Test Specifications**

The BS RF conformance tests are based on the core specification TS 36.101 and are defined in the TS 36.141.

- TS 36.113 "Base Station (BS) and repeater ElectroMagnetic Compatibility (EMC)"
- TS 36.141 "Base Station (BS) conformance testing"
  The BS RF Conformance Tests are described in chapter 8.3, "Supported Test Cases", on page 273.

### 8.1.3 Repeater Conformance Testing

The repeater conformance tests are based on the core specification TS 36.106 and defined in the TS 36.143 "FDD repeater conformance testing".

## 8.2 Basic Configuration

The basic equipment layout for preforming test with the aid of "Test Case Wizard" is the same as for the EUTRA/LTE signal generation. It includes the options:

- Baseband Main Module (R&S SMW-B13)
- Baseband Generator (R&S SMW-B10)
- Digital Standard EUTRA/LTE (R&S SMW-K55)
- Frequency option (R&S SMW-B10x)

However, some of the tests require further options. The additionally required hardware and/or software options are listed as a prerequisite in the description of the corresponding test case.

Test cases where the signal generator hardware and/or software equipment is not sufficient are shown in grey color but are not selectable.

RF power and frequency limitations of the hardware equipment restrict the setting ranges.

## 8.3 Supported Test Cases

The BS RF conformance tests defined in the TS 36.141 are divided into three main parts, the RF transmitter characteristics, the RF receiver characteristics and the RF performance requirements.

The "Test Case Wizard" supports the test cases listed in the tables below.

Only the test cases that require a signal generator are implemented in the "Test Case Wizard".

***Table 8-1: Transmitter Tests***

| Chapter in TS 36.141 | Test Case | Section in this document with further information |
|---|---|---|
| 6.2 | Base station output power | this test case does not require a signal generator |
| **Output power dynamics** | | |
| 6.3.1 | RE Power control dynamic range | |
| 6.3.2 | Total power dynamic range | |

| Chapter in TS 36.141 | Test Case | Section in this document with further information |
|---|---|---|
| 6.4 | Transmit ON/OFF power | |
| **Transmitted signal quality** | | |
| 6.5.1 | Frequency error | |
| 6.5.2 | Error Vector Magnitude | |
| 6.5.3 | Time alignment between transmitter branches | |
| 6.5.4 | DL RS power | |
| Unwanted emissions | | |
| 6.6.1 | Occupied bandwidth | |
| 6.6.2 | Adjacent Channel Leakage power Ratio (ACLR) | |
| 6.6.3 | Operating band unwanted emissions | |
| 6.6.4 | Transmitter spurious emissions | |
| 6.7 | Transmitter intermodulation | chap. 8.7.3, on page 292 |

***Table 8-2: Receiver Characteristics***

| Chapter in TS 36.141 | Test Case | Section in this document with further information |
|---|---|---|
| 7.2 | Reference sensitivity level | chap. 8.8.4, on page 304 |
| 7.3 | Dynamic range | chap. 8.8.5, on page 306 |
| 7.4 | In-channel selectivity | chap. 8.8.6, on page 308 |
| 7.5 | Adjacent Channel Selectivity (ACS) | chap. 8.8.7, on page 311 |
| | Narrow-band blocking | chap. 8.8.8, on page 314 |
| 7.6 | Blocking | chap. 8.8.9, on page 317 |
| 7.7 | Receiver spurious emissions | this test case does not require a signal generator |
| 7.8 | Receiver intermodulation | chap. 8.8.10, on page 320 |

***Table 8-3: Performance Requirement***

| Chapter in TS 36.141 | Test Case | Section in this document with further information |
|---|---|---|
| **Performance requirements for PUSCH** | | |
| 8.2.1 | Performance requirements of PUSCH in multipath fading propagation conditions | chap. 8.9.3, on page 329 |
| 8.2.2 | Performance requirements for UL timing adjustment | chap. 8.9.4, on page 332 |
| 8.2.3 | Performance requirements for HARQ-ACK multiplexed on PUSCH | chap. 8.9.5, on page 338 |

| Chapter in TS 36.141 | Test Case | Section in this document with further information |
|---|---|---|
| 8.2.4 | Performance requirements for High Speed Train conditions | chap. 8.9.6, on page 340 |
| | **Performance requirements for PUCCH** | |
| 8.3.1 | ACK missed detection for single user PUCCH format 1a | chap. 8.9.7, on page 345 |
| 8.3.2 | CQI performance requirements for PUCCH format 2 | chap. 8.9.8, on page 347 |
| 8.3.3 | ACK missed detection for multi user PUCCH format 1a | chap. 8.9.9, on page 349 |
| 8.3.4 | ACK missed detection for PUCCH format 1b, channel selection | chap. 8.9.10, on page 354 |
| 8.3.5 | ACK missed detection for PUCCH format 3 | chap. 8.9.11, on page 356 |
| 8.3.6 | NACK to ACK detection for PUCCH format 3 | chap. 8.9.12, on page 359 |
| 8.3.7 | CQI Performance for PUCCH format 2 with DTX detection | chap. 8.9.13, on page 361 |
| | **Performance requirements for PRACH** | |
| 8.4.1 | PRACH false alarm probability and missed detection | chap. 8.9.14, on page 364 |

### 8.3.1 Generic Structure of the Description of the Implemented Test Cases

The description of the test cases in this document follows a common structure.

- Test Case Number and Test Case Name
- Short Description and Test Purpose
  Some of the definitions are directly taken form the 3GPP test specification.
- Prerequisites, required hardware and software options
- Test setup
- Description of test case specific parameters

## 8.4 Standard Test Setups

The tests can be performed using the standard test setup according to TS 36.141. Test setups beside the three standard test setups described below are specified at the individual description of the corresponding test case.

### 8.4.1 Standard Test Setup - One Path

In case of two-path instruments signal routing to path A is assumed for the graph below. RF port A outputs the wanted signal (with or without fading and/or interference) and is

connected to the Rx port of the base station. The signal generator will start signal generation at the first received eNB frame trigger.

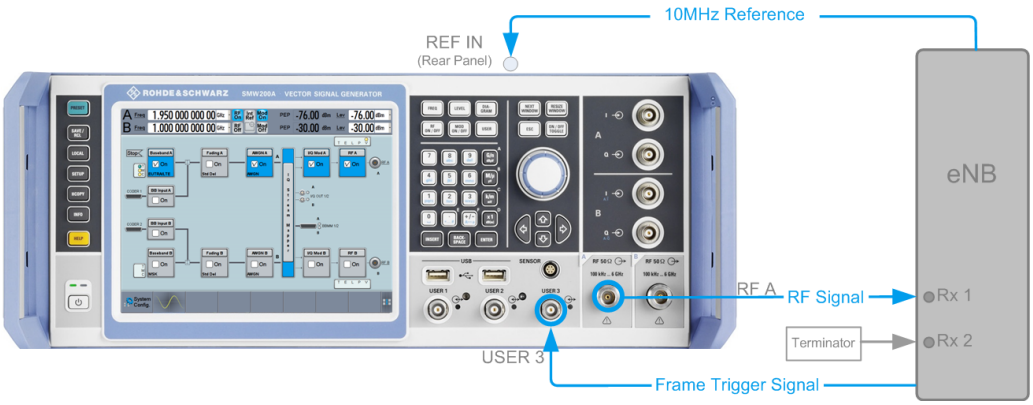



***Fig. 8-1: One Path Standard Test Setup (Example of R&S SMW simulating the test case 7.3 "Dynamic Range")***

For two-path instruments it is also possible to route baseband signal A to RF output B and connect RF output B to the Rx port of the base station.

## 8.4.2 Standard Test Setup - Two Paths

For two-paths measurements, the test cases always require option Second RF path (R&S SMW-B20x), a second option Baseband Main Module (R&S SMW-B13) and at least one option to generate the interfering signal in addition to the basic configuration. The signal routing is fixed.

The signal generator outputs the reference measurement channel signal, i.e. the wanted signal at output RF A and the interfering signal(s) at output RF B. After combining the two (three) signals the sum signal is fed into the base station Rx port. The signal generator will start signal generation at the first received eNB frame trigger.

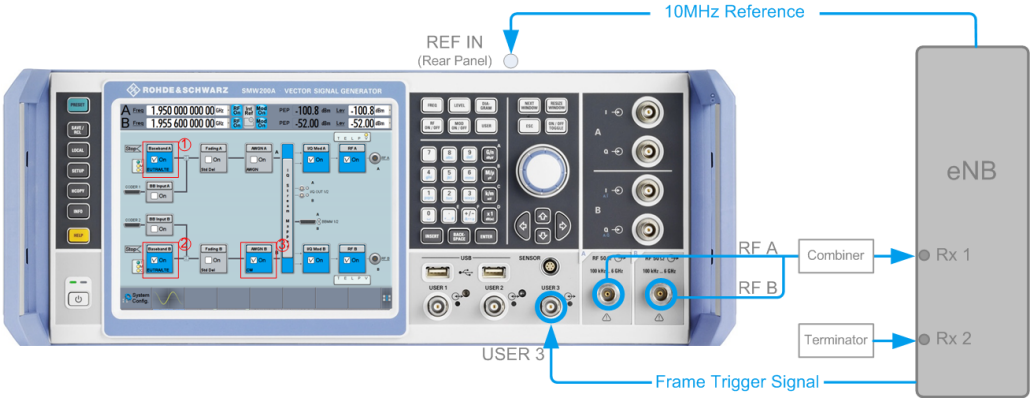



***Fig. 8-2: Two Paths Standard Test Setup (Example of R&S SMW simulating test case 7.8 "Receiver Intermodulation")***

1 = Baseband A generates the wanted signal
2 = Baseband B generates the EUTRA/LTE interfering signal
3 = AWGN B generates the CW interfering signal

### 8.4.3 Test Setup - Diversity Measurements

For diversity measurements, the test cases always require at least option Second RF path (R&S SMW-B20x) and a second option Baseband Main Module (R&S SMW-B13) in addition to the basic configuration. The signal routing is fixed.

RF output A and RF output B transmit the corrupted reference measurement channel signal (wanted signal) and are connected to the Rx ports of the base station for diversity reception. The signal generator will start signal generation at the first received eNB frame trigger.

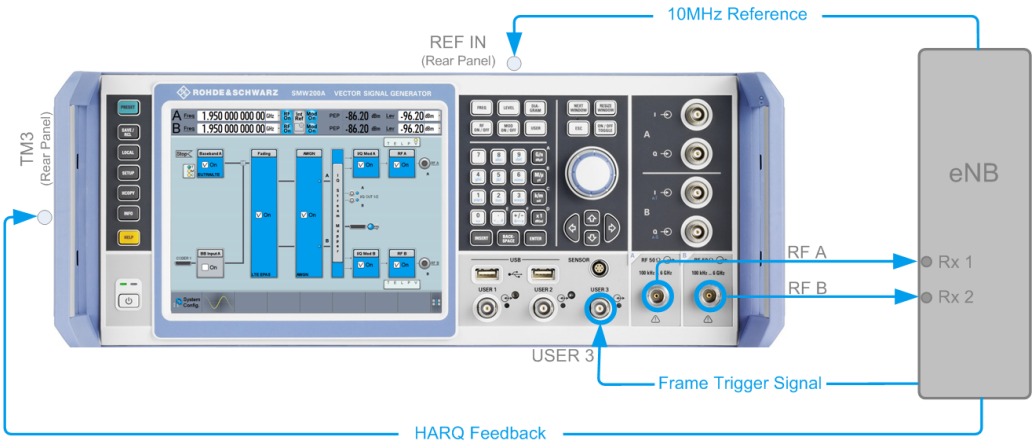



*Fig. 8-3: Test Setup for Diversity Measurements (Example of R&S SMW simulating test case 8.2.1 "PUSCH in Multipath Fading Propagation Conditions" with two Rx antennas)*

As signal routing takes place at the output of the baseband block, the interference settings of the two paths are identical for diversity measurements.

### 8.4.4 Test Setup - Four Rx Antennas

Test setup with four RX antennas require additional instrument(s) that act as external RF outputs for the R&S SMW, for example:

- two R&S SGS100A connected to the analog I/Q OUT 1/2 connectors of the instrument
- two R&S SMBV100A connected to the digital I/Q interfaces BBMM 1/2 OUT of the instrument
- one two-path signal generator, e.g. a R&S SMU200A or a second R&S SMW

The external instruments have to be equipped with the suitable frequency options. The signal routing is fixed.

RF output A and RF output B transmit the corrupted reference measurement channel signal (wanted signal) and are connected to the Rx ports of the base station for diversity reception. The signal generator will start signal generation at the first received eNB frame trigger.

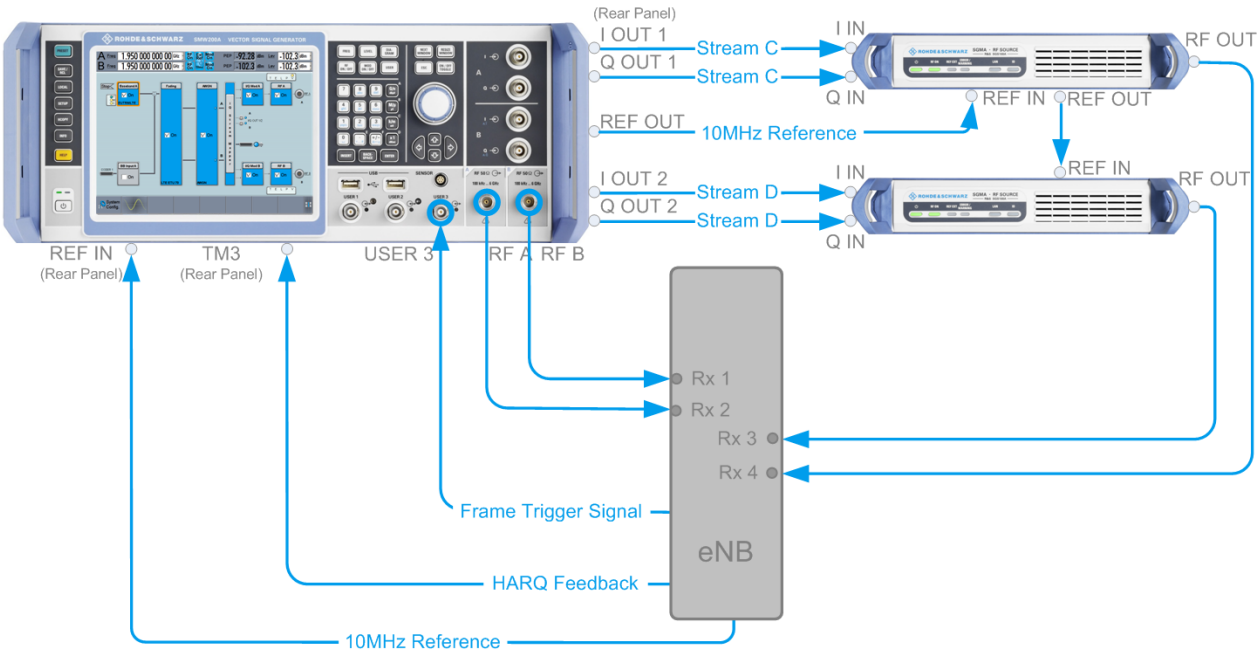



***Fig. 8-4: Test Setup for tests with four Rx antennas (Example of R&S SMW and 2xR&S SGS simulating test case 8.2.1 "PUSCH in Multipath Fading Propagation Conditions")***

grey connectros = rear panel connectors
blue connectors = front panel connectors

As signal routing takes place at the output of the baseband block, the interference settings of the two paths are identical for diversity measurements.

## 8.5 General Considerations

This section lists some common topics for all BS RF conformance tests. Considerations, that are specific to one conformance test part, are described at the corresponding section.

### Test Frequencies

EUTRA/LTE is designed to operate in the operating bands defined in table 8-4. The table shows the start and the stop frequencies of both uplink and downlink frequency bands according to 3GPP TS 36.141.

***Table 8-4: EUTRA/LTE operating bands***

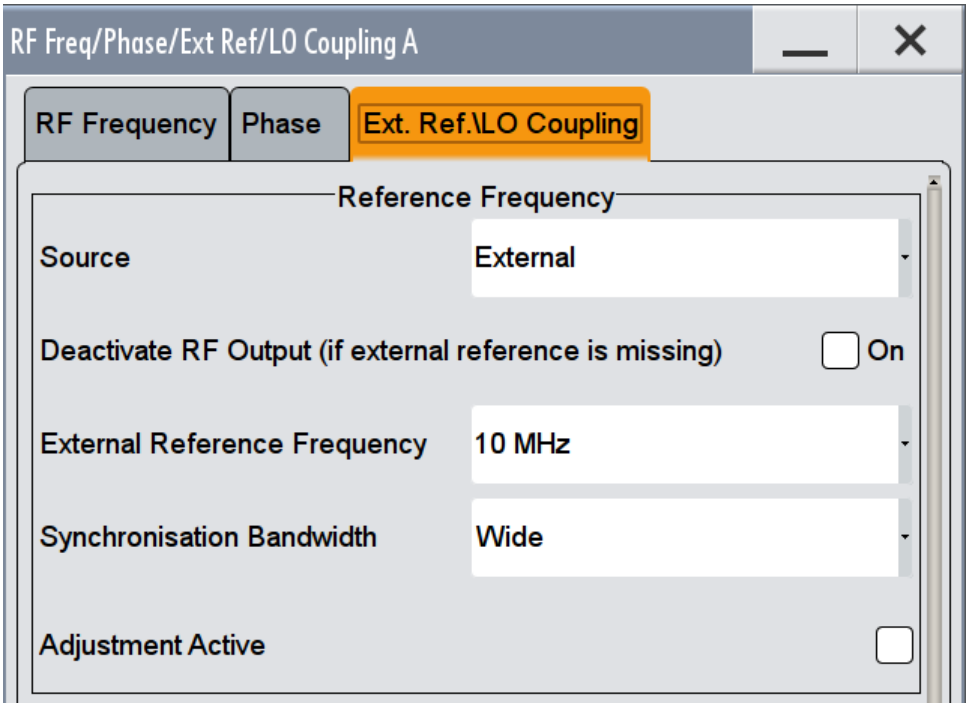
| EUTRA Operating Band | Uplink (UL) band BS receive UE transmit<br>$F_{UL\_low}$ to $F_{UL\_high}$ | Downlink (DL) operating band BS transmit UE receive<br>$F_{DL\_low}$ to $F_{DL\_high}$ | Duplex Mode |
|---|---|---|---|
| 1 | 1920 MHz to 1980 MHz | 2110 MHz to 2170 MHz | FDD |
| 2 | 1850 MHz to 1910 MHz | 1930 MHz to 1990 MHz | FDD |
| 3 | 1710 MHz to 1785 MHz | 1805 MHz to 1880 MHz | FDD |

| EUTRA Operating Band | Uplink (UL) band BS receive UE transmit $F_{UL\_low}$ to $F_{UL\_high}$ | Downlink (DL) operating band BS transmit UE receive $F_{DL\_low}$ to $F_{DL\_high}$ | Duplex Mode |
|---|---|---|---|
| 4 | 1710 MHz to 1755 MHz | 2110 MHz to 2155 MHz | FDD |
| 5 | 824 MHz to 849 MHz | 869 MHz to 894MHz | FDD |
| 6 | 830 MHz to 840 MHz | 875 MHz to 885 MHz | FDD |
| 7 | 2500 MHz to 2570 MHz | 2620 MHz to 2690 MHz | FDD |
| 8 | 880 MHz to 915 MHz | 925 MHz to 960 MHz | FDD |
| 9 | 1749.9 MHz to 1784.9 MHz | 1844.9 MHz to 1879.9 MHz | FDD |
| 10 | 1710 MHz to 1770 MHz | 2110 MHz to 2170 MHz | FDD |
| 11 | 1427.9 MHz to 1447.9 MHz | 1475.9 MHz to 1495.9 MHz | FDD |
| 12 | 699 MHz to 716 MHz | 729 MHz to 746 MHz | FDD |
| 13 | 777 MHz to 787 MHz | 746 MHz to 756 MHz | FDD |
| 14 | 788 MHz to 798 MHz | 758 MHz to 768 MHz | FDD |
| ... | | | |
| 17 | 704 MHz to 716 MHz | 734 MHz to 746 MHz | FDD |
| ... | | | |
| 33 | 1900 MHz to 1920 MHz | 1900 MHz to 1920 MHz | TDD |
| 34 | 2010 MHz to 2025 MHz | 2010 MHz to 2025 MHz | TDD |
| 35 | 1850 MHz to 1910 MHz | 1850 MHz to 1910 MHz | TDD |
| 36 | 1930 MHz to 1990 MHz | 1930 MHz to 1990 MHz | TDD |
| 37 | 1910 MHz to 1930 MHz | 1910 MHz to 1930 MHz | TDD |
| 38 | 2570 MHz to 2620 MHz | 2570 MHz to 2620 MHz | TDD |
| 39 | 1880 MHz to 1920 MHz | 1880 MHz to 1920 MHz | TDD |
| 40 | 2300 MHz to 2400 MHz | 2300 MHz to 2400 MHz | TDD |

The measurements that have to be performed according to 3GPP TS 36.141 for verifying a proper operation of systems apply to appropriate frequencies in the bottom, middle and top of the operating frequency band of the base station (BS). These frequencies are denoted as RF channels B (bottom), M (middle) and T (top).

### Reference Frequency

When building up the measurement setups according to TS 36.141 it might be useful that all the instruments share a common reference clock. When you feed an external clock, the RF module configuration should be switched to external reference frequency.




In the external reference mode an external signal with selectable frequency and defined level must be input at the REF IN connector. This signal is output at the REF OUT connector. The reference frequency setting is effective for both paths. For achieveing very good reference sources of high spectral purity a wideband setting is provided.

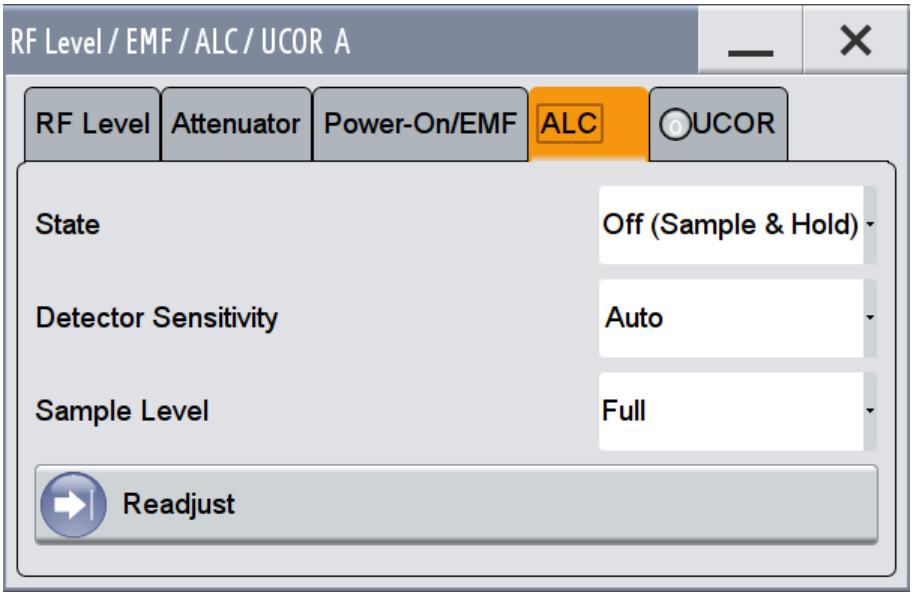
### Baseband Clock

The clock source is automatically switched to internal when the test case settings are activated.

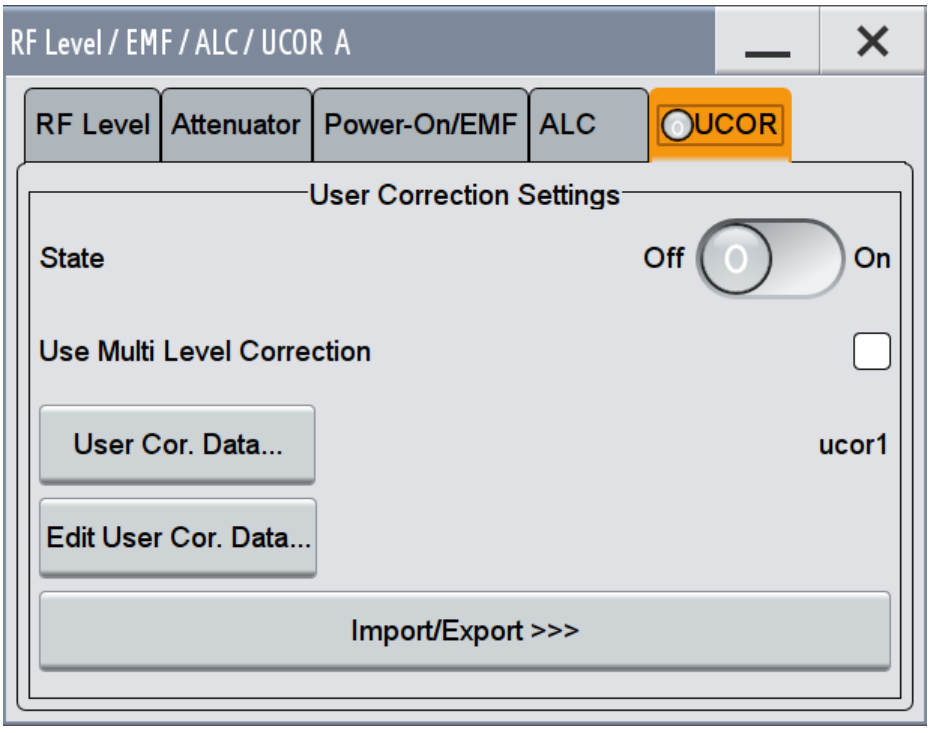
### Improvement of signal quality

Improvement of signal quality is possible via several settings:

- In the "I/Q Mod > I/Q Mod Settings" dialog, select a "Baseband Gain = 2 dB" to improve the ACLR performance
- In the "Automatic Level Control Settings" menu the RF output level can be recalibrated with "Readjust" in "Sample&Hold" mode. This is recommended if in CW mode the signal/intermodulation ratio is to be improved for multi-transmitter measurements. With setting "Auto", the level control is automatically adapted to the operating conditions, it may cause increased intermodulation, however.




- In the "User Correction" menu a list of correction values can be created and subsequently activated. Thus, the frequency response of the test setup can be taken into account .




- In order to compensate cable loss and additionally inserted attenuators, the RF level can directly be adjusted in the "Level" input field.

**Virtual Resource Block (VRB) Offset**

In the R&S Signal Generator the RBs are allocated by default at the left edge of the spectrum. However, some test cases do not require allocation of the entire bandwidth or RB allocation at a specific part of the bandwidth. Adjust the additional parameter "Offset VRB" to define the position of the RBs.

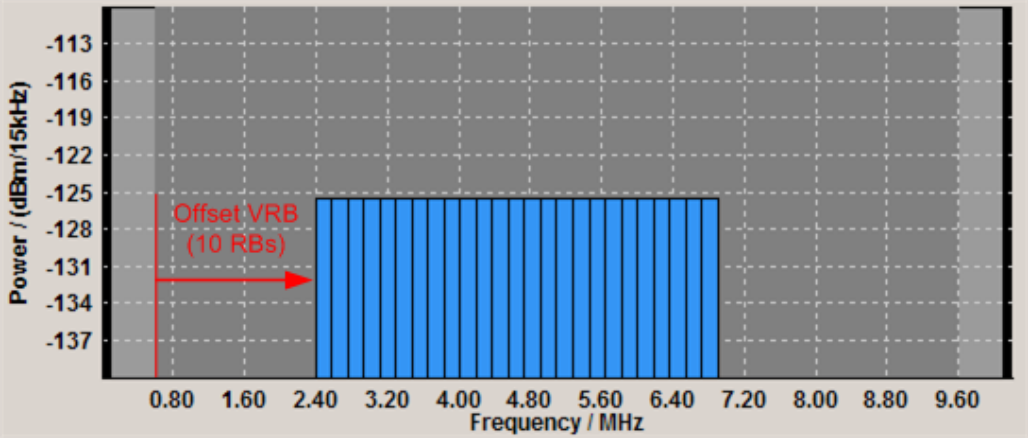
**Example: Offset VRB**

"Channel Bandwidth" = 10 MHz, i.e. 50 RBs

"Allocated Resource Blocks" = 25

"Offset VRB" = 10

The RBs are offset by 10 RBs and allocated RBs start at position 11.




Use also the SC-FDMA Timeplan to visualize the RB allocation for the wanted signal (path A) and the interfering signal (path B).

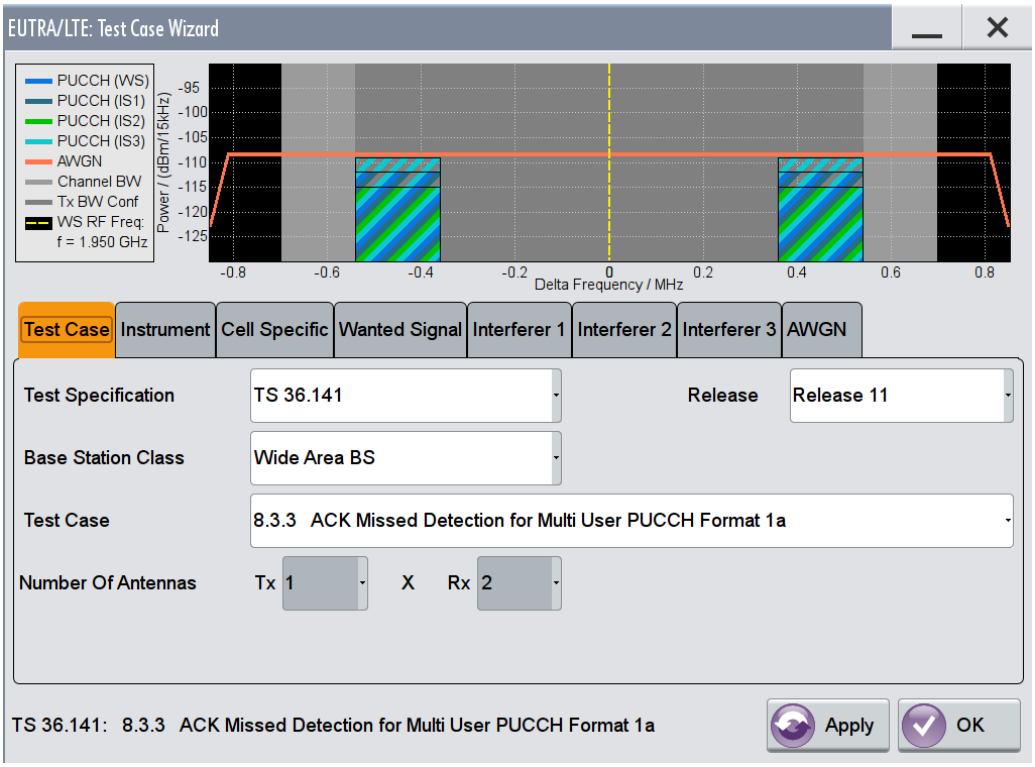
## 8.6 User Interface

► To access the "Test Case Wizard" dialog, select "Baseband Block > EUTRA/LTE > Test Case Wizard".

There is only one "Test Case Wizard" in the instrument, i.e. the same dialog can be accessed via each of the baseband blocks.

The "Test Case Wizard" dialog is devided into several tabs: the "Test Case" tab for selecting the test case, the "TMR" tab for settings regarding routing, trigger and marker configuration, one ore more tabs with corresponding names comprising the additional parameters like the configuration of the wanted and interfering signals, AWGN and fading settings and the "Apply " button.

The graph symbolizes the interference scenario defined by power level and frequency offset. A permanent display shows a graph of the currently selected test case.




## 8.6.1 Test Case Settings

This dialog comprises the settings for selecting the test case, the 3GPP test specification and release as well as other general settings.

**Test Specification**
Displays the 3GPP test specification used as a guide line for the test cases.

**Release**
Displays the 3GPP test specification release version used as a guide line for the test cases.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:GS:RELease` on page 542

**Base Station Class**
Determines whether the test is to be performed for a local area, home area, medium range or a wide area base station. The different base station classes are specified for different output power ("Power Level" on page 289).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:GS:BSCLass` on page 543

**Test Case**
Selects the test case.

**Note:** Not all test case are available for all instruments. The enabled test cases depend on the instrument's hardware (e.g. instrument equipped with one or two paths, etc) and/ or the installed SW options (e.g. Fading Simulator, etc.).

See chapter 8.3, "Supported Test Cases", on page 273 for an overview of the available test cases.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:TC` on page 550

**Number of Rx Antennas**
For performance requirement tests, determines the number of the Rx antennas.

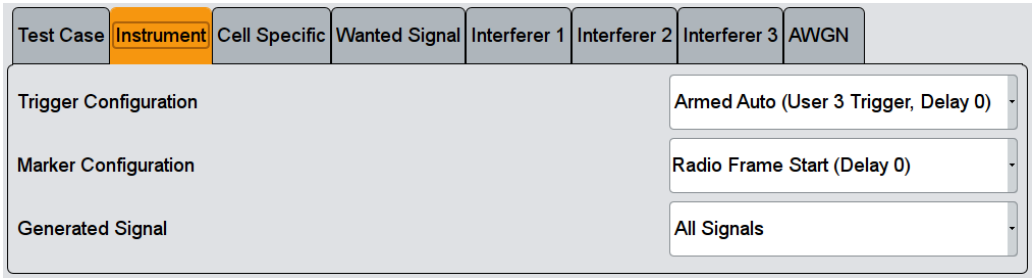
Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:GS:RXANtennas` on page 544

**Number of Tx Antennas**
For performance requirement tests, determines the number of the Tx antennas.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:GS:TXANtennas` on page 544

## 8.6.2 Instrument Settings

The "Instrument" dialog comprises instrument related settings, like trigger and marker settings or routing related settings.




**Trigger Configuration**
Selects the trigger configuration. The trigger is used to synchronize the signal generator to the other equipment.

"Armed Auto (User 3 Trigger, Delay 0)"
The trigger settings are customized for the selected test case. The following settings apply:

- "Trigger Mode > Armed Auto"
- "Trigger Source > External Global Trigger 1"
- "Global Connector Settings > User 3 > Direction > Input" and "User 3 > Signal > Global Trigger 1"
- "Trigger Delay = 0"
  Thus, the base station frame timing is able to synchronize the signal generator by a periodic trigger.

"Unchanged" The current trigger settings of the signal generator are retained unchanged.

Remote command:
[:SOURce<hw>]:BB:EUTRa:TCW:GS:TRIGgerconfig on page 544

**Marker Configuration**
Selects the marker configuration. The marker can be used to synchronize the measuring equipment to the signal generator.

"Radio Frame Start (Delay 0)" The marker settings are customized for the selected test case. The following settings apply:

- "Marker Mode 1/2/3 > Radio Frame Start"
- "Global Connector Settings > User 1/2 > Direction > Output" and "User 1/2 > Signal > Baseband A Marker 1/2"
  "Local Connector Settings > T/M 2/3 > Direction > Output" and "T/M 2/3 > Signal > Marker A 1/2"
  marker signals Marker 1 and Marker 2 are output at the local T/M 2/3 and global USER1/2 connectors
- "Marker Delay = 0"

"Unchanged" The current marker settings of the signal generator are retained unchanged.

Remote command:
[:SOURce<hw>]:BB:EUTRa:TCW:GS:MARKerconfig on page 543

**Instrument Setup**
(two-path instruments only)

Determines whether only one or both paths are used.

Remote command:
[:SOURce<hw>]:BB:EUTRa:TCW:GS:INSTsetup on page 542

**Signal Routing**
Selects the signal routing for baseband A signal which in most test cases represents the wanted signal.

"To Path and RF Port A" The baseband signal A is routed to RF output A.

"To Path and RF Port B" (two-path instruments only)
The baseband signal A is routed to RF output B.
**Tip:** Some transmitter tests like test case 7.2 requre separate measurements on both Rx port. Use this feature to route the same baseband signal to the second RF output and perform the measurements.

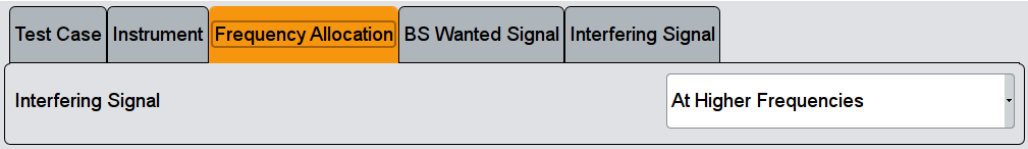
Remote command:
[:SOURce<hw>]:BB:EUTRa:TCW:GS:SIGRout on page 544

**Antenna Subset**
In test setups with more than two Rx antennas, determines the signal of which antenna couple ("Antenna 1 and 2" or "Antenna 3 and 4") or of all antennas is generated by the instrument.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:GS:ANTSubset` on page 542

## 8.6.3 Frequency Allocation Settings

Determines the frequency position of the wanted and the interfering signal.




**Frequency Allocation of the Interfering signal**
Determines the frequency position of the wanted and the interfering signal.

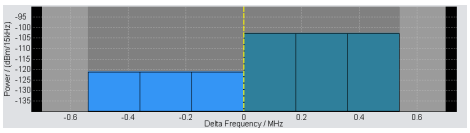
**Example: Wanted and inerfering signal within the same channel**

"Test Case" = 7.4 "In Channel Selectivity"

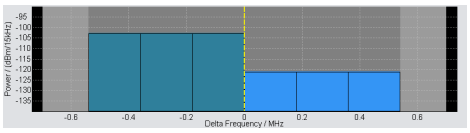
"Channel Bandwidth" = 1.4 MHz

The parameter "Frequency Allocation" determines the position of the allocated RBs within the channel. Allocation in the lower or higher frequencies is possible.

**"Frequency Allocation of the Interfering signal" = At Higher Resource Blocks**



**"Frequency Allocation of the Interfering signal" = At Lower Resource Blocks**



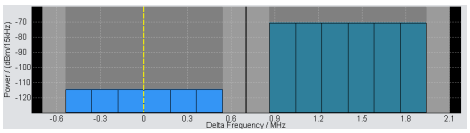
**Example: Interfering signal in the adjacent channel**

"Test Case" = 7.5A "Adjacent Channel Selectivity"

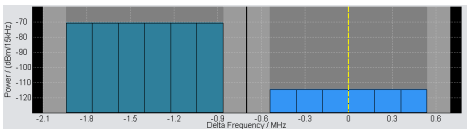
"Channel Bandwidth" = 1.4 MHz

The parameter "Frequency Allocation" determines the position of the wanted signal compared to the interfering signal. Allocation in the lower or higher frequencies is possible, i.e. the position of the allocated bandwidth of the wanted and the intefering signal can be mirrored.

**"Frequency Allocation of the Interfering signal" = At Higher Resource Blocks**



**"Frequency Allocation of the Interfering signal" = At Lower Resource Blocks**



Remote command:

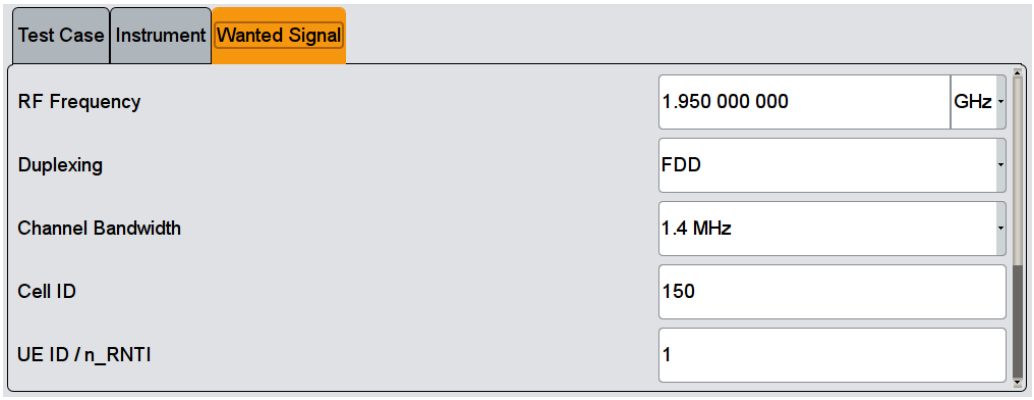
`[:SOURce<hw>]:BB:EUTRa:TCW:FA:FRALlocation` on page 542

`[:SOURce<hw>]:BB:EUTRa:TCW:FA:RBALlocation` on page 542

## 8.6.4 Wanted Signal and Cell Specific Settings

The following settings are available for almost all transmitter and receiver characteristics and performance requirements tests. Specific parameters are listed together with the description of the corresponding test case.

For the in-channel test cases 7.4, 8.2.2 and 8.3.3, the cell specific settings apply also for the interfering signal, respectively for the signal of the stationary UE.




**RF Frequency**
Sets the RF frequency of the wanted signal.

Remote command:

`[:SOURce<hw>]:BB:EUTRa:TCW:WS:RFFRequency` on page 555

**Duplexing**
Selects whether TDD or FDD duplexing mode is used (see also"Duplexing" on page 78 ).

Remote command:
[:SOURce<hw>]:BB:EUTRa:TCW:WS:DUPLex on page 552

**TDD UL/DL Configuration**
For TDD mode, selects the UL/DL Configuration number (see also "UL/DL Configuration" on page 136).

Remote command:
[:SOURce<hw>]:BB:EUTRa:TCW:WS:TDDConfig on page 556

**Signal Advance N_TA_offset**
Sets the parameter $N_{TAoffset}$ (see also"Signal Advance N_TA_offset" on page 84 ).

Remote command:
[:SOURce<hw>]:BB:EUTRa:TCW:WS:NTAOffset on page 553

**Channel Bandwidth**
Selects the channel bandwidth (see also chapter 7.14.1, "Physical Settings", on page 202).

Remote command:
[:SOURce<hw>]:BB:EUTRa:TCW:WS:CHBW on page 551

**Cell ID**
Sets the Cell ID (see alsochapter 7.14.2, "Cell Specific Settings", on page 204 ).

Remote command:
[:SOURce<hw>]:BB:EUTRa:TCW:WS:CLID on page 552

**Cyclic Prefix**
Selects normal or extended cyclic prefix.

Remote command:
[:SOURce<hw>]:BB:EUTRa:TCW:WS:CYCPrefix on page 552

**UE ID/n_RNTI**
Sets the UE ID/n_RNTI.

Remote command:
[:SOURce<hw>]:BB:EUTRa:TCW:WS:UEID on page 556

**FRC**
Displays the fixed reference channel used. An overview of the FRCs and the cross-reference between the selected Channel Bandwidth and the FRC is given in the individual description of the test cases.

Remote command:
[:SOURce<hw>]:BB:EUTRa:TCW:WS:FRC on page 553

**Offset VRB**
Sets the number of RB the allocated RB(s) are shifted with (see also example "Offset VRB" on page 282).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:WS:OVRB` on page 554

**Power Level**
Displays the power level, depending on the selected test case.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:WS:PLevel?` on page 554

### 8.6.5 Apply Settings

The "Apply" trigger a selective preset of the signal generator prior to presetting the setting according to the selected test case. Further modification of the generator settings is still possible. Signal generation starts with the first trigger event.

Use "Ok" to apply the settings and close the dialog.

**Apply Settings**
Activates the current settings of the test case wizard.

**Note:** The settings of the selected test case becomes active only after selecting "Apply Settings".

Initialization of the signal generator with the test case settings is performed by a partial selective reset that includes only the baseband, fading and AWGN module and the RF frequency and RF level settings. Other settings of the signal generator are not altered.

Before triggering the signal generator the user still can change these other settings. This is particularly useful when compensating for cable loss and additionally inserted attenuators by adjusting the RF power level offset is required.

Signal generation is started at the first trigger received by the generator. The RF output is not activated /deactivated by the test case wizard. Activate the "RF > State > On" at the beginning of the measurement.

**Note:** For safety reasons the RF is not active unless the button "RF ON" has been selected.

**Note:** The settings in the dialogs "EUTRA/LTE > Trigger/Marker/Clock" and in the "Global/Local Connector Settings" are not affected by the selective preset, if the parameter "Trigger/Marker Configuration" is set to "Unchanged".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:APPLysettings` on page 541

## 8.7 Transmitter Characteristics (TS 36.141, Chapter 6)

The transmitter characteristics comprises the maximum output power, output power dynamics, transmitted signal quality, unwanted emissions and transmitter intermodula-

tions. The "Test Case Wizard" supports the generation of signals in accordance with the transmitter intermodulations test case. A brief description about the unwanted emission tests is also provided (see chapter 8.7.2, "Introduction to the Unwanted Emissions Tests", on page 290).

## 8.7.1 Prior Considerations

### Test Models

For the transmitter characteristic tests EUTRA test models (E-TM) are specified. For an overview of the test models, see "EUTRA Test Models (E-TM) Downlink" on page 105.

### Channels

According to the TS 36.141, the channels to test are located in the bottom (B), middle (M) and the top (T) of the supported frequency range of the base station. See table 8-4 for an overview of the supported frequency operating bands.

### Filter Settings

The 3GPP EUTRA/LTE specifications do not define a standardized transmit filter neither for the UE nor for the base station. Therefore, when a test case is activated, a filter type EUTRA/LTE with "Best ACP Optimization" is automatically selected.

### Test Setup

Transmitter tests require a separate measuring equipment, e.g. the Vector Signal Analyzer R&S FSV.

## 8.7.2 Introduction to the Unwanted Emissions Tests

The unwanted emissions from the transmitter are divided into two main groups, the out-of-band (OOB) emissions and the spurious emissions. The out-of-band emissions are emissions on frequencies close to the frequency of the wanted signal. Spurious emissions are emissions caused by unwanted transmitter effects, like harmonics, parasitic emissions, intermodulation products and frequency conversion products.

- ACLR
  The Adjacent Channel Leakage power Ratio (ACLR) is defined as the ratio between the power transmitted in the channel bandwidth of the wanted signal to the power of the unwanted emissions transmitted on the adjacent channel.
  The corresponding receiver requirement is the Adjacent Channel Selectivity (ACS), described in chapter 8.8.7, "Test Case 7.5A: Adjacent Channel Selectivity (ACS)", on page 311.
  The test specifications defines ACLR requirements for LTE and UTRA receivers. Different settings applies for paired and unpaired spectrum (see table 8-5 and table 8-6).

*Table 8-5: Base Station ACLR in paired spectrum*

| EUTRA transmitted signal channel bandwidth $BW_{Channel}$, MHz | BS adjacent channel center frequency offset below the first or above the last carrier center frequency transmitted | Assumed adjacent channel carrier (informative) | Filter on the adjacent channel frequency and corresponding filter bandwidth | ACLR limit |
|---|---|---|---|---|
| 1.4 / 3 / 5 / 10 / 15 / 20 | $BW_{Channel}$ | EUTRA of same BW | Square ($BW_{Config}$) | 44.2 dB |
| | $2xBW_{Channel}$ | EUTRA of same BW | Square ($BW_{Config}$) | |
| | $BW_{Channel}$/2+ 2.5 MHz | 3.84 Mcps UTRA | RRC (3.84 Mcps) | |
| | $BW_{Channel}$/2+ 7.5 MHz | 3.84 Mcps UTRA | RRC (3.84 Mcps) | |

*Table 8-6: Base Station ACLR in unpaired spectrum with synchronized operation*

| EUTRA transmitted signal channel bandwidth $BW_{Channel}$, MHz | BS adjacent channel center frequency offset below the first or above the last carrier center frequency transmitted | Assumed adjacent channel carrier (informative) | Filter on the adjacent channel frequency and corresponding filter bandwidth | ACLR limit |
|---|---|---|---|---|
| 1.4 / 3 | $BW_{Channel}$ | EUTRA of same BW | Square ($BW_{Config}$) | 44.2 dB |
| | $2xBW_{Channel}$ | EUTRA of same BW | Square ($BW_{Config}$) | |
| | $BW_{Channel}$/2+ 0.8 MHz | 1.28 Mcps UTRA | RRC (1.28 Mcps) | |
| | $BW_{Channel}$/2+ 2.4 MHz | 1.28 Mcps UTRA | RRC (1.28 Mcps) | |
| 5 / 10 / 15 / 20 | $BW_{Channel}$ | EUTRA of same BW | Square ($BW_{Config}$) | |
| | $2xBW_{Channel}$ | EUTRA of same BW | Square ($BW_{Config}$) | |
| | $BW_{Channel}$/2+ 0.8 MHz | 1.28 Mcps UTRA | RRC (1.28 Mcps) | |
| | $BW_{Channel}$/2+ 2.4 MHz | 1.28 Mcps UTRA | RRC (1.28 Mcps) | |
| | $BW_{Channel}$/2+ 2.5 MHz | 3.84 Mcps UTRA | RRC (3.84 Mcps) | |
| | $BW_{Channel}$/2+ 7.5 MHz | 3.84 Mcps UTRA | RRC (3.84 Mcps) | |
| | $BW_{Channel}$/2+ 5 MHz | 7.68 Mcps UTRA | RRC (7.68 Mcps) | |
| | $BW_{Channel}$/2+ 15 MHz | 7.68 Mcps UTRA | RRC (7.68 Mcps) | |

- Operating Band Unwanted Emissions
  The 3GPP specification introduces the term operating band unwanted emissions instead of the spectrum mask. The operating band unwanted emissions requirements are defined from 10 MHz below the lowest frequency of the downlink operating band up to 10 MHz above the highest frequency of the operating band.

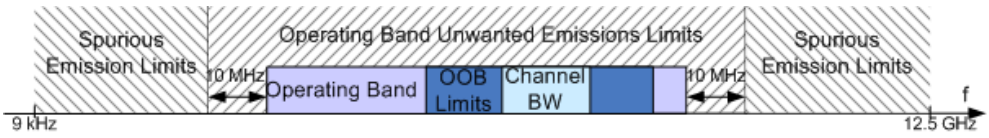



*Fig. 8-5: Transmitter tests frequency limits*

The operating band unwanted emissions require a 100 kHz measurement bandwidth.

- Spurious Emissions
  The transmitter spurious emissions limits apply from 9 kHz to 12.5 GHz, excluding the frequency range defined for the operating band unwanted emissions (see figure 8-5).
  Refer to table 8-7 for an overview of the general settings for the measurements. Additional requirements may apply for co-existence with other systems and/or co-location with other base stations. For detailed requirements, refer to the 3GPP TS 36.141.

*Table 8-7: Spurious emissions*

| Frequency range | Maximum level Category A | Maximum level Category B | Measurement Bandwidth |
|---|---|---|---|
| 9kHz - 150kHz | -13 dBm | -36 dBm | 1 kHz |
| 150kHz - 30MHz | | | 10 kHz |
| 30MHz - 1GHz | | | 100 kHz |
| 1GHz - 12.75 GHz | | -30 dBm | 1 MHz |

## 8.7.3 Test Case 6.7: Transmitter Intermodulation

### Test Purpose

The test purpose is to verify the ability of the BS transmitter to restrict the generation of intermodulation products in its non linear elements caused by presence of the own wanted signal and an interfering signal reaching the transmitter via the antenna [6].

### Required Options

See chapter 8.2, "Basic Configuration", on page 273.

### Test Setup

The RF OUT of the signal generator is connected to the analyzer via a circulator and external attenuator. The Tx signal of the base station is connected to the RF input of the analyzer via a circulator. The following figure illustrates the basic test setup.

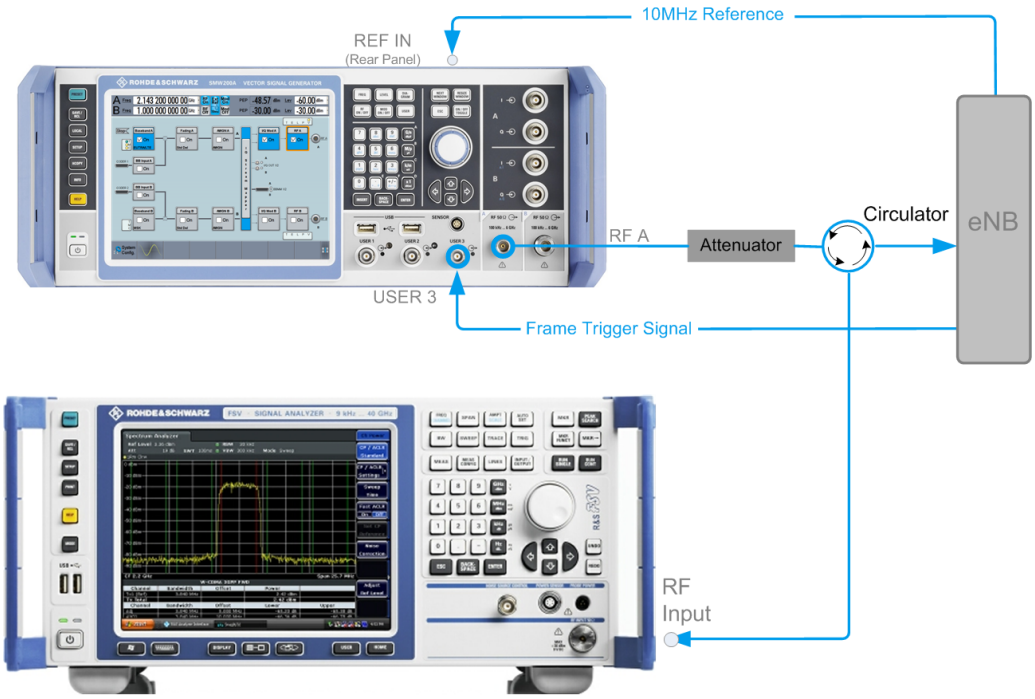



*Fig. 8-6: Test setup for Test case 6.7: Transmitter Intermodulation*

### Short Description

The transmitter intermodulation test is intended to verify the ability of the BS transmitter to restrict the generation of intermodulation products in its non linear elements caused by presence of wanted signal and an interfering signal reaching the transmitter via the antenna.

The BS transmits signals in accordance with E-TM1.1 at maximum power and with channel bandwidth $BW_{Channel}$ corresponding to the maximum bandwidth supported by the base station. The interfering signal is an E-TM1.1 signal with 5 MHz channel bandwidth. The interfering signal power shall be 30 dB lower than the power of the wanted signal at the frequency offsets of ±2.5 MHz, ±7.5 MHz and ±12.5 MHz.

The transmit intermodulation level shall not exceed the out-of-band emission requirements and transmitter spurious emissions requirements for all third and fifth order intermodulation products which appear in the frequency ranges defined in table 8-5, table 8-6 and table 8-7. For detailed information about the operating band unwanted emissions, refer to section 6.6.3.5 in 3GPP TS 36.141 [6].

The test shall be done on three channels (B, M and T).

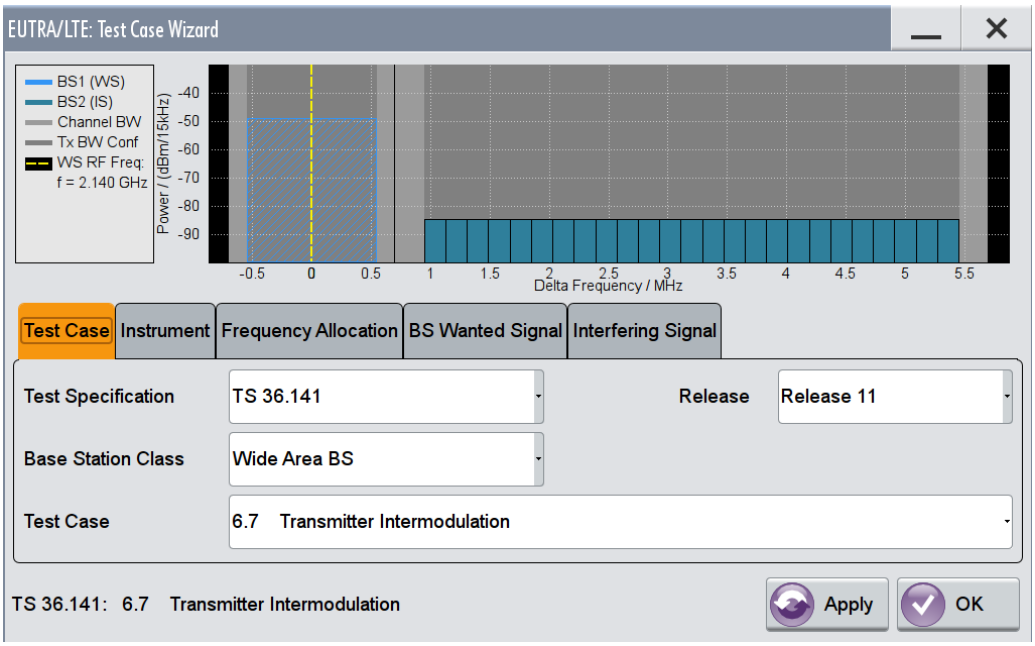
### General Workflow for Carrying Out a Test Case 6.7 Measurement

The following describes the general workflow, only the basic steps are listed.
For detailed description about working with the analyzer and the base station, refer to the corresponding description.

1. Set the base station to the basic state and configure it for the selected test case.
   a) Initialize the base station,
   b) Set the base station to test model E-TM1.1,
   c) Set maximum transmit power,
   d) Set the frequency.
2. Set the signal generator to the basic state
   a) Preset the signal generator unless some settings (e.g. in terms of I/Q and RF blocks) have to be kept.
3. Set the analyzer to the basic state
4. Set the test case wizard
   a) Select "Baseband Block > EUTRA/LTE > Test Case Wizard"
   b) Select "Test Case 6.7: Transmitter Intermodulation".
      The parameters are preset according to TS 36.141
   c) Adjust the settings of the wanted signal (RF level and Channel Bandwidth).
   d) Enter the test frequency (e.g. M). It must be the same as the base station has been set to.
   e) Enter the Interfering Signal parameters.
   f) Activate the settings with the "Apply Settings" button.
      The signal generator is now ready to start signal generation
5. Set the analyzer to the measurement frequency and perform further necessary settings.
   Refer to the description of the analyzer for further information.
6. In the signal generator, switch on the RF output.
7. Start the measurement
   a) Send a start trigger impulse from the base station to the signal generator and to the analyzer.

   The signal generator outputs the test model interfering signal; Measurement procedures are started.
8. Calculate the result
   The analyzer calculates the out-of-band emission and the spurious emission.

### User Interface




### Base Station Wanted Signal

The common settings of the wanted signal are described in chapter 8.6.4, "Wanted Signal and Cell Specific Settings", on page 287.

### Output Power Level ← Base Station Wanted Signal

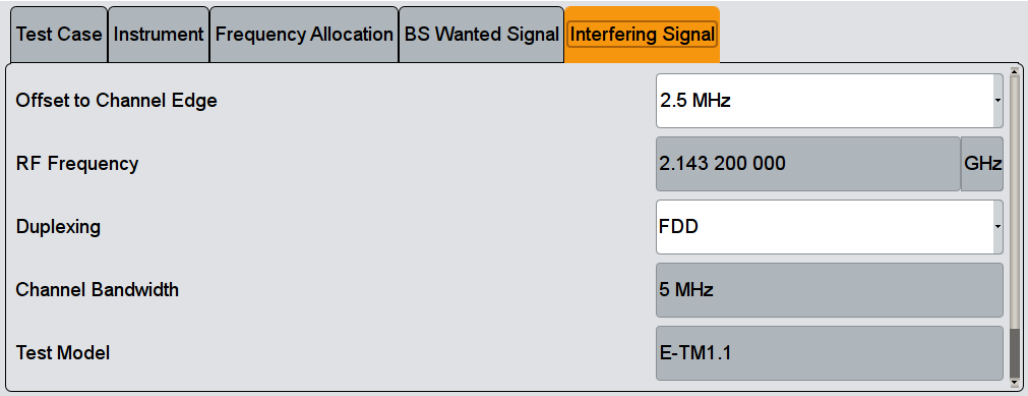
Sets the output power level of the wanted signal. The power level of the interfering signal is always 30 dB lower than this level.

Remote command:

`[:SOURce<hw>]:BB:EUTRa:TCW:WS:OUPLevel` on page 554

### Interfering Signal

Comprises the settings of the interfering signal.




The interfering signal is an E-TM1.1 signal with 5 MHz channel bandwidth and center frequency relative to the carrier frequency of the wanted signal.

**Offset to Channel Edge ← Interfering Signal**
Defines the offset of the interfering signal center frequency relative to edge of the wanted channel bandwidth. This parameter determine the carrier frequency of the interfering signal (see FR Frequency).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:IS:OCEdge` on page 546

**FR Frequency ← Interfering Signal**
Displays the RF Frequency of the interfering signal, determined by the RF Frequency of the wanted signal and the selected Offset to Channel Edge.

The $RF\ Frequency_{interfering\ signal}$ is calculated as follow:

- For "Frequency Allocation" set to "Interfering Signal at Higher Frequencies"
  "$RF\ Frequency_{interfering\ signal}$" = "$RF\ Frequency_{wanted\ signal}$" + Delta
- For "Frequency Allocation" set to "Interfering Signal at Lower Frequencies"
  "$RF\ Frequency_{interfering\ signal}$" = "$RF\ Frequency_{wanted\ signal}$" - Delta

Where for both cases **Delta** is calculated as follow:

Delta = "$BW_{wanted\ signal}$"/2 + $Offset_{interfering\ signal}$

**Example:**

"$BW_{wanted\ signal}$" = 1.4 MHz

"RF $Frequency_{wanted\ signal}$" = 1 950 MHz

$Offset_{interfering\ signal}$ = 7.5 MHz

Delta = 1.4/2 + 7.5 = 8.2 MHz

For "Frequency Allocation" = "Interfering Signal at Higher Frequencies" the "RF $Frequency_{interfering\ signal}$" = 1 950 + 8.2 = 1 958.2 GHz

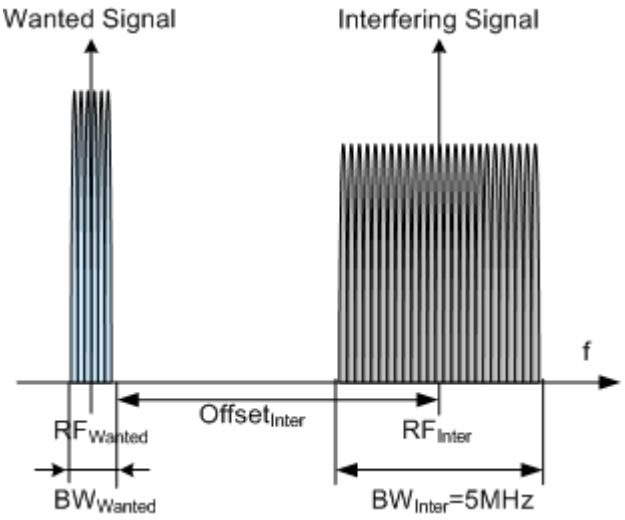



*Fig. 8-7: Example: Offset to Channel Edge (Channel Bandwidth = 1.4 MHz)*

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:IS:RFFRequency` on page 547

**Duplexing ← Interfering Signal**
Selects whether TDD or FDD duplexing mode is used.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:IS:DUPLex` on page 545

**Channel Bandwidth ← Interfering Signal**
Displays the channel bandwidth of the interfering signal. The value is fixed to 5 MHz.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:IS:CHBW?` on page 545

**Test Model ← Interfering Signal**
Displays the test model. The interfering signal is generated according to E-TM1.1 test model.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:IS:TMODel?` on page 548

**Power Level ← Interfering Signal**
Displays the power level of the interfering signal. The power level is always 30 dB below the Output Power Level of the wanted signal.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:IS:PLevel?` on page 547

## 8.8 Receiver Characteristics (TS 36.141, Chapter 7)

Most of the receiver tests can be performed with the signal generator only, i.e. without additional measurement equipment.

The receiver requirements are divided into the following main categories, intended to

- Prove the receiver's ability to receive the wanted signal:
  - chapter 8.8.4, "Test Case 7.2: Reference Sensitivity Level", on page 304
  - chapter 8.8.5, "Test Case 7.3: Dynamic range", on page 306
- Prove how susceptible the receiver is to different types of interfering signals:
  - chapter 8.8.6, "Test Case 7.4: In-channel selectivity (ICS)", on page 308
  - chapter 8.8.7, "Test Case 7.5A: Adjacent Channel Selectivity (ACS)", on page 311
  - chapter 8.8.8, "Test Case 7.5B: Narrow-band blocking", on page 314
  - chapter 8.8.9, "Test Case 7.6: Blocking", on page 317
  - chapter 8.8.10, "Test Case 7.8: Receiver intermodulation ", on page 320

  The several test cases shell cover a wide range of scenarios with different types of impairments on the wanted signal, that occur depending on the frequency offset between the wanted and the interfering signal.

### 8.8.1 Prior Considerations

**Fixed Reference Channels (FRC)**

The receiver tests use fixed reference channels (FRC) as defined in 3GPP TS 36.141, Annex A "Reference Measurement channels".

The following FRCs are defined for the receiver tests:

- FRC A1: A1-1 .. A1-5 (QPSK)
- FRC A2: A2-1 .. A2-3 (16QAM)

Refer to table 7-12 for an overview of all supported FRC.

### Channels

According to the TS 36.141, the channels to test are located in the bottom (B), middle (M) and the top (T) of the supported frequency range of the base station. See table 8-4 for an overview of the supported frequency operating bands.

### Channel Bandwidth of the LTE Interfering Signal

For all test cases using an interfering LTE signal, the bandwidth of the interfering signal shall be the same as the wanted signal, but at the most 5 MHz.

### Reference Sensitivity Power Level $P_{REFSENS}$

$P_{REFSENS}$ depends on the channel bandwidth as specified in TS 36.104 [9], subclause 7.2.1. The table 8-8 gives an overview of the resulting power levels for the wanted signal per test case.

***Table 8-8: BS reference sensitivity levels***

| Channel Bandwidth, MHz | Reference sensitivity power level, $P_{REFSENS}$, dBm | ACS Test Case<br>Wanted signal mean power, dBm | Narrow-band Blocking/Blocking/ Receiver Intermodulation Test Case<br>Wanted signal mean power, dBm |
|---|---|---|---|
| 1.4 | -106.8 | -95.9 | -100.8 |
| 3 | -103.0 | -95.0 | -97.0 |
| 5 /10 /15 /20 | -101.5 | -95.5 | -95.5 |

### Power Settings

The "Level Reference" parameter in the "Filter/Clipping/Power Settings" dialog is automatically set to "Frame RMS Power" for FDD Duplexing Mode and to "UL Part of Frame RMS Power" for TDD Duplexing Mode.

### Filter Settings

The 3GPP EUTRA/LTE specifications do not define a standardized transmit filter neither for the UE nor for the base station. Therefore, when a test case is activated, a filter type EUTRA/LTE with "Best EVM Optimization" is automatically selected. An exception are the Test Case 7.5A: Adjacent Channel Selectivity (ACS) and the Test Case 7.5B: Narrow-band blocking wehre a "Best ACP Optimization" filter is applied for shaping the interfering signal.

## 8.8.2 General Workflow for Carrying Out a Receiver Test

The following instructions lists the general steps for performing a BS conformance test with the help of "Test Case Wizard". Specific requirements are described together with the individual test case.

For detailed description about the configuration of the base station, refer to the corresponding description.

1. Connect the R&S SMW and the DUT according to the corresponding test case setup. See also chapter 8.4, "Standard Test Setups", on page 275.
2. Set the base station to the basic state
   a) Initialize the base station
   b) Set the frequency
   c) Set the base station to receive the Fixed Reference Channel (for most receiver test cases)
3. Preset the signal generator to ensure a defined instrument state.
4. Configure the test case wizard
   a) Select "Baseband Block > EUTRA/LTE > Test Case Wizard".
   b) Select a test case, e.g. "TS 36.141: 7.3 Dynamic Range".
   c) Enter additional required parameters.
   d) Enter the test frequency (e.g. M). It must be the same as the base station has been set to.
   e) Activate the settings with the "Apply Settings" button.

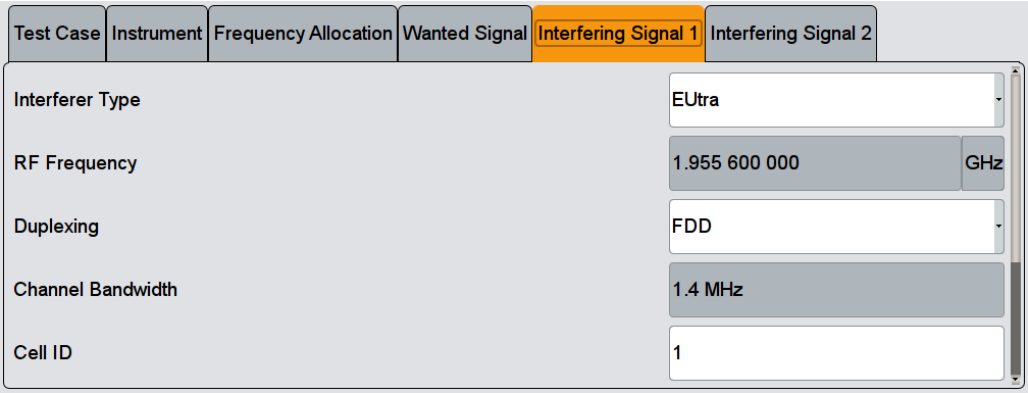
   The signal generator is now ready to start signal generation
5. Switch on RF output
6. If required, make additional settings (e.g. in the "I/Q Mod" or "RF" block) or change test case settings.
7. Start the measurement
   a) Send a start trigger impulse from the base station to the signal generator.

   The signal generator will start signal generation.
8. Calculate the result

   The base station internally calculates the BER, BLER or Pd depending on the test case. This value is compared to the required value.

### 8.8.3 Interfering Signal Settings

The following settings are available for almost all receiver tests, requiring an interfering signal. Specific parameters are listed together with the description of the corresponding test case.




**Interferer Type**
(enabled for Blocking and Receiver Intermodulation tests)

Selects the type of the interfering signal:

- For **Blocking** tests, the interfering signal can be an in-band EUTRA/LTE signal or out-of-band CW signal.
- For **Receiver Intermodulation** tests, the first interfering signal can be an EUTRA/LTE signal or narrow-band EUTRA signal.
  The second interfering signal is always a CW signal.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:IS:IFTYpe` on page 546

**RF Frequency**
Display the center frequency of the interfering signal.

The center frequency is calculated as follow:

- For "Frequency Allocation" set to "Wanted Signal at Lower Frequencies"
  "RF Frequency$_{\text{interfering signal}}$" = "RF Frequency$_{\text{wanted signal}}$" + Delta
- For "Frequency Allocation" set to "Wanted Signal at Higher Frequencies"
  "RF Frequency$_{\text{interfering signal}}$" = "RF Frequency$_{\text{wanted signal}}$" - Delta

Where for both cases Delta is calculated as follow:

Delta = "Channel Bandwidth$_{\text{wanted signal}}$"/2 + Offset$_{\text{interfering signal}}$

**Example:**

"Channel Bandwidth$_{\text{wanted signal}}$" = 5 MHz

"RF Frequency$_{\text{wanted signal}}$" = 1 950 MHz

Offset$_{\text{interfering signal}}$ = 2.5025 MHz (see table 8-12)

Delta = 5/2 + 2.5025 = 5.0025 MHz

For "Frequency Allocation" = "Wanted Signal at Lower Frequencies" the "RF Frequency$_{\text{interfering signal}}$" = 1 950 + 5.0025 = 1 955.0025 MHz

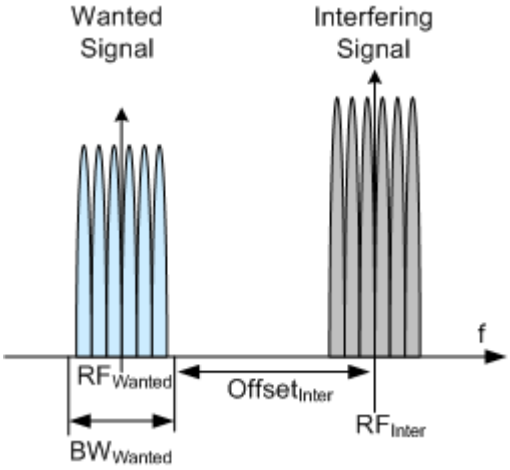



*Fig. 8-8: Example: Adjacent Channel Selectivity (ACS), Channel BW = 1.4 MHz*

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:IS:RFFRequency` on page 547

**Duplexing**
Selects whether TDD or FDD duplexing mode is used.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:IS:DUPLex` on page 545

**TDD UL/DL Configuration**
For TDD mode, selects the UL/DL Configuration number.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:IS:TDDConfig` on page 548

**Signal Advance N_TA_offset**
Sets the parameter $N_{TAoffset}$ (see also "Signal Advance N_TA_offset" on page 84).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:IS:NTAOffset` on page 546

**Channel Bandwidth**
Displays the channel bandwidth of the interfering signal. The interfering signal has the same bandwidth as the wanted signal, but at the most 5 MHz.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:IS:CHBW?` on page 545

**Cell ID**
Sets the Cell ID for the interfering signal.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:IS:CLID` on page 545

**UE ID/n_RNTI**
Sets the UE ID/n_RNTI for the interfering signal.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:IS:UEID` on page 548

**Number of Resource Blocks**
The number of RBs used by the LTE interfering signal is set automatically:

- For **ACS and In-channel Selectivity measurements**, the number of RBs depends on the selected channel bandwidth for the wanted signal. The bandwidth of the interfering signal is equal to the bandwidth allocated for the wanted signal, but at the most 5 MHz.
- For **Narrow-band Blocking** tests, the interfering signal is a single resource block LTE signal.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:IS:NRBlock?` on page 546

**Offset VRB**
(Test Case 7.4 and 7.5 only)

The position of the RBs allocated by the LTE interfering signal is determined automatically, depending on the selected "Channel Bandwidth" and the RBs allocation of the wanted signal.

- For **in-channel testing**, the parameter "Offset VRB" is used to allocate the wanted and the interfering signal around the center frequency (see also figure 8-9).
- For **ACS testing**, the "Offset VRB" is fixed to 0.
- For **narrow band blocking testing**, the "Offset VRB" is set in the way, that depending on the "Frequency Allocation" of the interfering signal, the narrow-band LTE interfering signal is allocated at the most left or the most rigth subcarrier in the allocated channel bandwidth

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:IS:OVRB?` on page 547

**Frequency Shift m**
(Test Case 7.5 only)

By default, the narrow-band LTE interfering signal is allocated at the most left (interfering signal at higher frequencies)/ most right (interfering signal at lower frequencies) subcarrier in the allocated channel bandwidth. However, the position of the interfering signal can be set by means of the parameter "Frequency Shift m", i.e. the allocated RB can be offset to a different center frequency (see figure 8-10).

The parameter Interfering RB Center Frequency displays the center frequency of the resource block the interfering signal is currently allocated on.

The value range of the parameter depends on the selected "Channel Bandwidth", as defined in table 8-13.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:IS:FRSHift` on page 545

**Interfering RB Center Frequency**
(for Narrow-band Block tests only)

Displays the center frequency of the single resource block interfering signal (see also figure 8-10).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:IS:RBCFrequency` on page 547

**Power Level**
The power level of the interfering LTE signal is set automatically depending on the selected channel bandwidth.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:IS:PLevel?` on page 547

### 8.8.4 Test Case 7.2: Reference Sensitivity Level

**Test Purpose**

To verify that at the BS Reference sensitivity level the throughput requirement shall be met for a specified reference measurement channel [6].

**Required Options**

See chapter 8.2, "Basic Configuration", on page 273.

**Test Setup**

See chapter 8.4.1, "Standard Test Setup - One Path", on page 275

**Short Description**

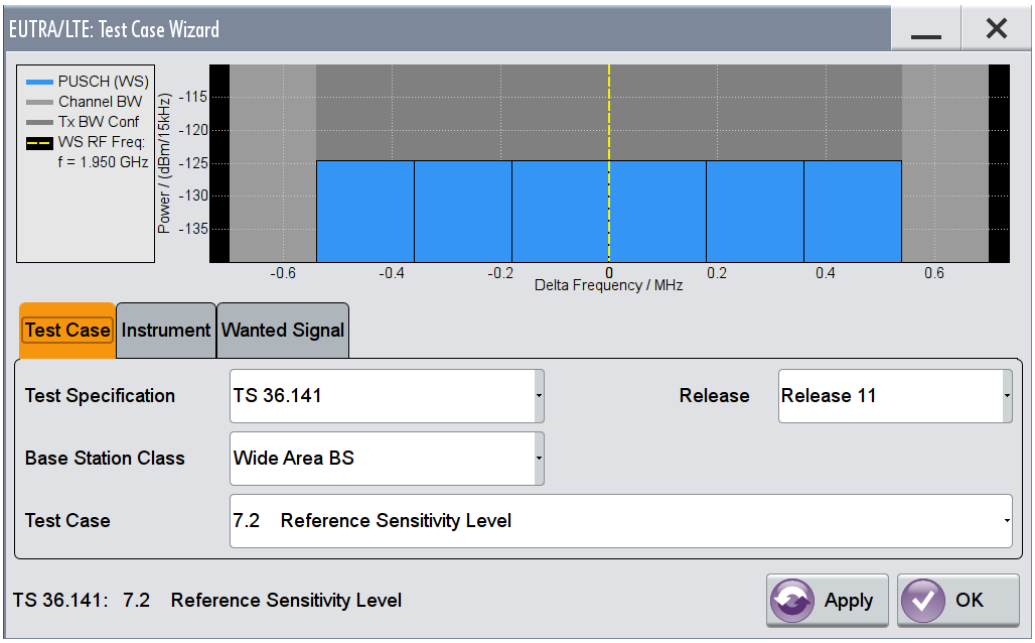
The reference sensitivity level measurement is a test case that aims to verify the Noise Figure of the receivers. The test case uses FRCs with QPSK modulation.

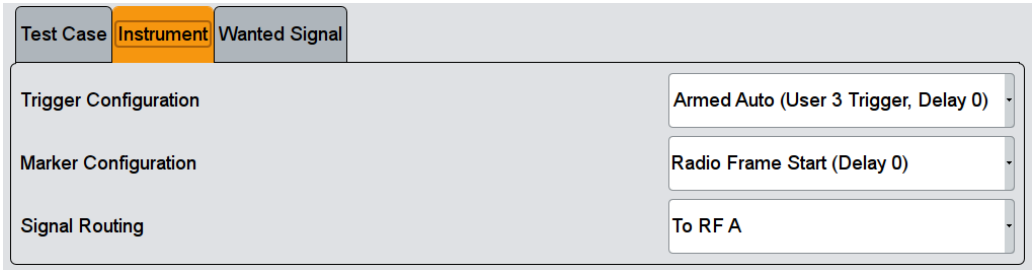
The test shall be done on three channels (B, M and T). The selected "Channel Bandwidth" determines the used FRC and the "Wanted Signal Power Level". For channels larger than 5 MHz not all RBs are allocated; the position of the allocated RBs within the selected channel bandwidth can be adjusted by means of the parameter "Offset VRB".

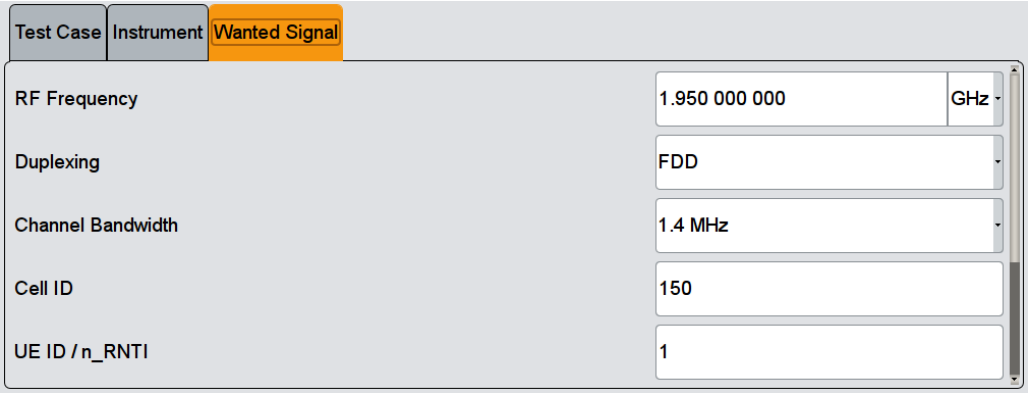
For the parameter in the table 8-9 the throughput measured shall be equal or grater than 95%.

***Table 8-9: Reference sensitivity levels***

| Channel Bandwidth, MHz | Reference Measurements Channel | Reference sensitivity power level $P_{REFSENS}$, dBm |
|---|---|---|
| 1.4 | FRC A1-1 | -106.1 |
| 3 | FRC A1-2 | -102.3 |
| 5 / 10 / 15 / 20 | FRC A1-3 | -100.8 |






The general and instrument related settings are described in Test Case Settings and Instrument Settings

The settings of the wanted signal are described in chapter 8.6.4, "Wanted Signal and Cell Specific Settings", on page 287.

### 8.8.5 Test Case 7.3: Dynamic range

#### Test Purpose

To verify that at the BS receiver dynamic range, the relative throughput shall fulfil the specified limit [6].

#### Required Options

- See chapter 8.2, "Basic Configuration", on page 273.
- Option Additive White Gaussian Noise AWGN (R&S SMW-K62)

#### Test Setup

See chapter 8.4.1, "Standard Test Setup - One Path", on page 275

#### Short Description

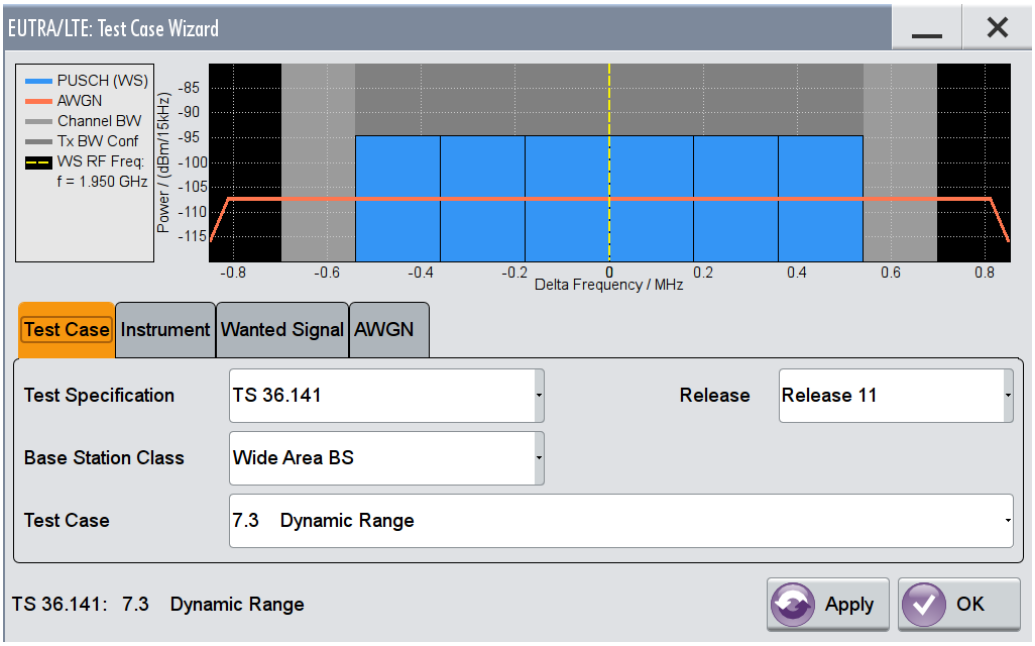
The dynamic range test case aims to stress the receiver and measure its capability to demodulate the useful signal even in the presence of a heavy interfering signal inside the received channel bandwidth. The test case uses FRCs with 16QAM modulation. The throughout measurements are performed for different level of the wanted and the interfering AWGN signals.

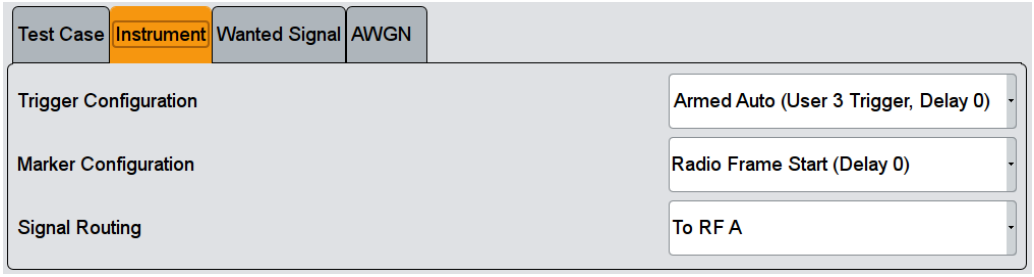
The test shall be done on three channels (B, M and T). The selected "Channel Bandwidth" determines the used FRC and the "Wanted Signal Power Level". For channels larger than 5 MHz not all RBs are allocated; the position of the allocated RBs within the selected channel bandwidth can be adjusted by means of the parameter "Offset VRB".

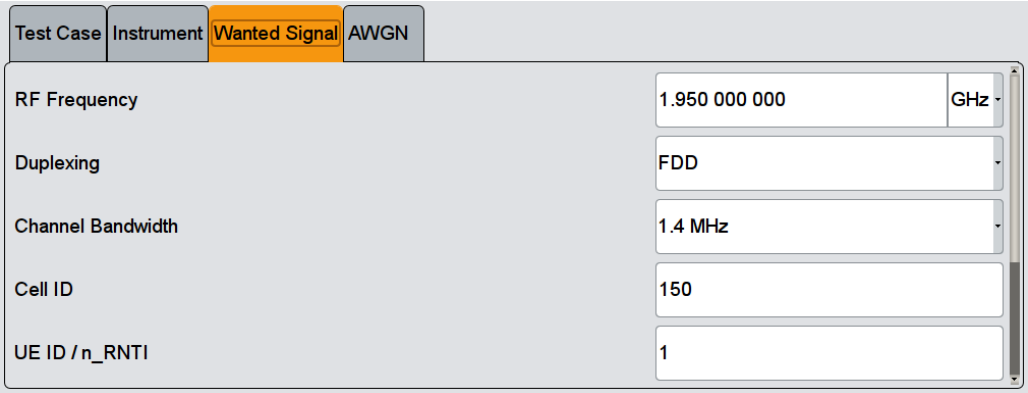
For the parameter in the table 8-9 the throughput shall be equal or grater than 95%.

*Table 8-10: Dynamic range*

| Channel Band-width, MHz | Reference Measurements Channel | Wanted signal mean power, dBm | Interfering signal mean power, dBm / $BW_{Config}$ | Type of interfering signal |
|---|---|---|---|---|
| 1.4 | FRC A2-1 | -76.0 | -88.7 | AWGN |
| 3 | FRC A2-2 | -72.1 | -84.7 | AWGN |
| 5 | FRC A2-3 | -69.9 | -82.5 | AWGN |
| 10 | FRC A2-3 | -69.9 | -79.5 | AWGN |
| 15 | FRC A2-3 | -69.9 | -77.7 | AWGN |
| 20 | FRC A2-3 | -69.9 | -76.4 | AWGN |






The general and instrument related settings are described in Test Case Settings and Instrument Settings

The settings of the wanted signal are described in chapter 8.6.4, "Wanted Signal and Cell Specific Settings", on page 287.

**AWGN Configuration**
Comprises the settings of the interfering signal.

**Power Level ← AWGN Configuration**
Displays the power level of the AWGN signal. The value is set automatically according to table 8-10 and depending on the selected Channel Bandwidth.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:AWGN:PLevel?` on page 541

## 8.8.6 Test Case 7.4: In-channel selectivity (ICS)

### Test Purpose

The purpose of this test is to verify the BS receiver ability to suppress the IQ leakage [6].

### Required Options

The required options depend on whether the test will be performed with an instrument equipped with one or two paths.

- Instrument equipped with one path:
  See chapter 8.2, "Basic Configuration", on page 273.
- Instument equipped with two paths:
  - See chapter 8.2, "Basic Configuration", on page 273.
  - Option Second RF path (R&S SMW-B20x)

– Second Option Baseband Generator (R&S SMW-B10)
– Option Baseband Main Module (R&S SMW-B13T)
– Second Option Digital Standard EUTRA/LTE (R&S SMW-K55)

### Test Setup

See chapter 8.4.1, "Standard Test Setup - One Path", on page 275 or chapter 8.4.2, "Standard Test Setup - Two Paths", on page 276

### Short Description

In-channel selectivity (ICS) is a measure of the receiver ability to receive a "weak" wanted signal at its assigned Resource Block locations in the presence of a "strong" interfering signal. The interfering signal shall be an EUTRA/LTE signal with the same bandwidth as the wanted signal, but at the most 5 MHz. The wanted and the interfering signal are allocated around the center frequency (see figure 8-9); to swap the position of the wanted and interfering signal, use the parameter "Frequency Allocation".

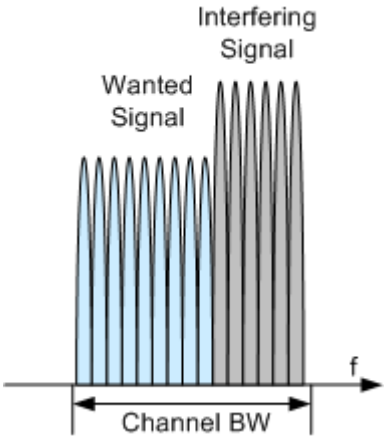



*Fig. 8-9: Example: In-channel selectivity (ICS), Channel BW = 3 MHz, Frequency Allocation = Lower Frequency*

The test shall be done on three channels (B, M and T). The selected "Channel Bandwidth" determines the used FRC and the "Wanted Signal Power Level". For channels larger than 5 MHz not all RBs are allocated.

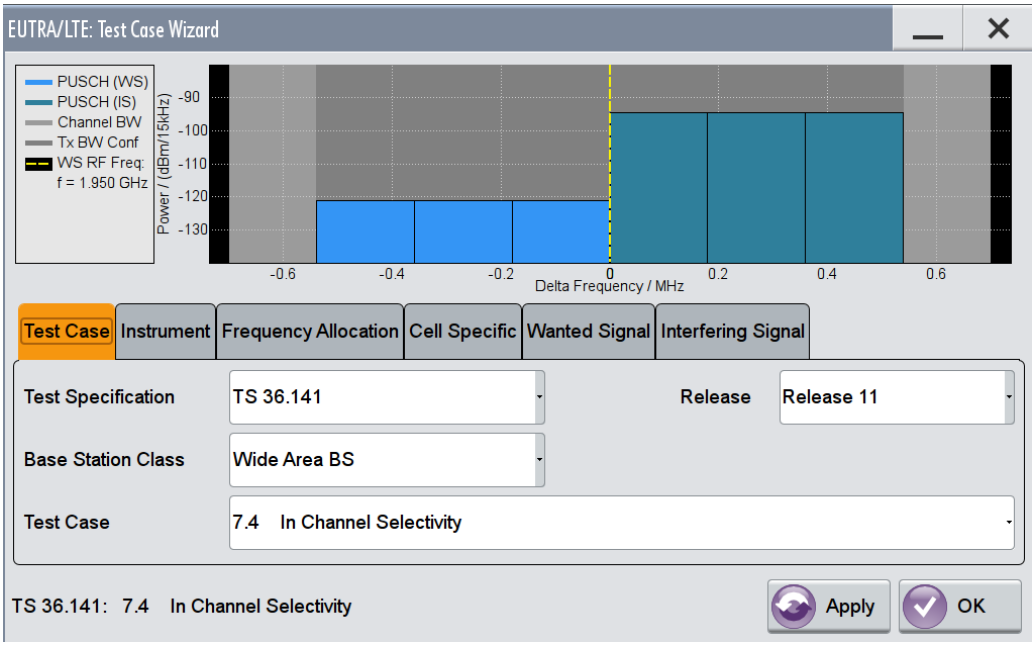
For the parameter in the table 8-11 the throughput shall be equal or grater than 95%.

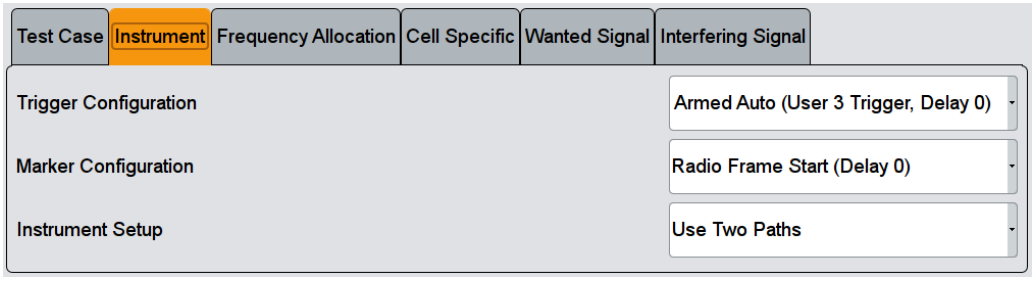
*Table 8-11: In-channel selectivity*

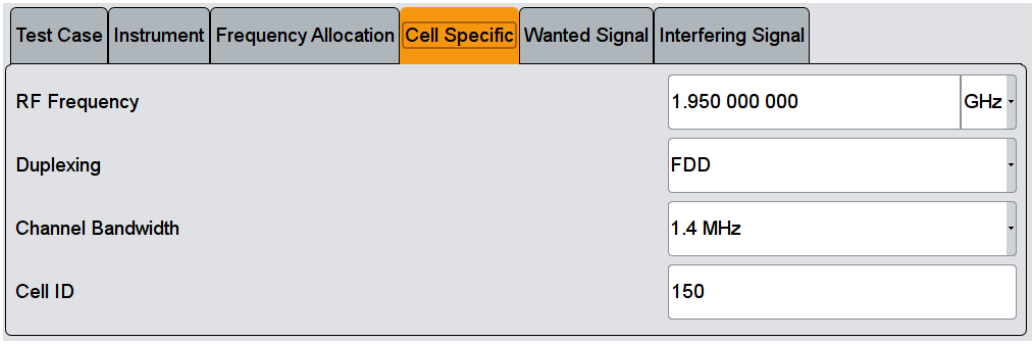
| Channel Bandwidth, MHz | Reference Measurements Channel | Wanted signal mean power, dBm | Interfering signal mean power, dBm / $BW_{Config}$ | Type of interfering signal |
|---|---|---|---|---|
| 1.4 | FRC A1-4 | -105.5 | -87 | 1.4 MHz EUTRA signal, 3 RBs |
| 3 | FRC A1-5 | -100.7 | -84 | 3 MHz EUTRA signal, 6 RBs |
| 5 | FRC A1-2 | -98.6 | -81 | 5 MHz EUTRA signal, 10 RBs |

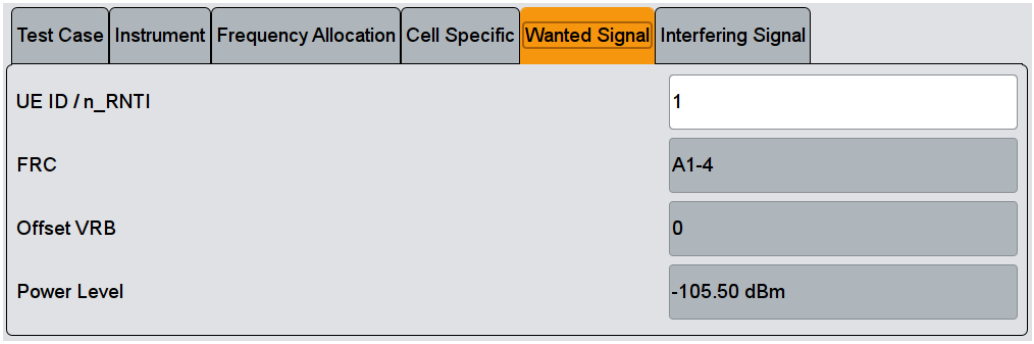
| Channel Bandwidth, MHz | Reference Measurements Channel | Wanted signal mean power, dBm | Interfering signal mean power, dBm / $BW_{Config}$ | Type of interfering signal |
|---|---|---|---|---|
| 10 | FRC A1-3 | -97.1 | -77 | 10 MHz EUTRA signal, 25 RBs |
| 15 | FRC A1-3 | -97.1 | -77 | 15 MHz EUTRA signal, 25 RBs* |
| 20 | FRC A1-3 | -97.1 | -77 | 20 MHz EUTRA signal, 25 RBs* |

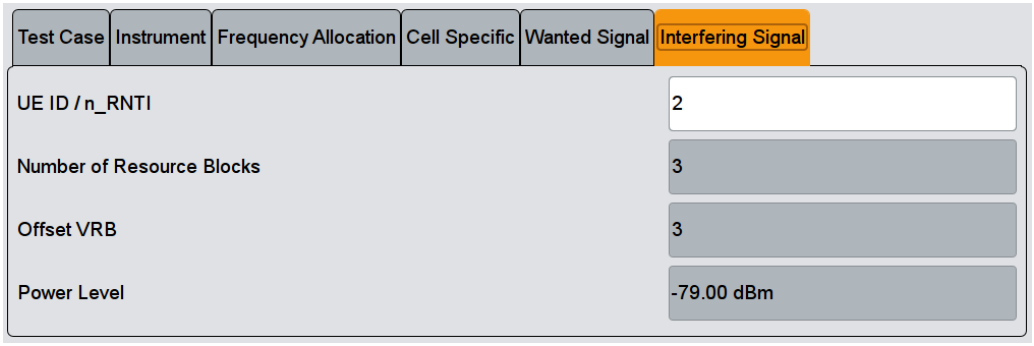
*) Wanted and interfering signal are placed adjacently around the carrier frequency






The general and instrument related settings are described in Test Case Settings and Instrument Settings

The cell specific settings and the settings of the wanted signal are described in chapter 8.6.4, "Wanted Signal and Cell Specific Settings", on page 287.

Refer to chapter 8.8.3, "Interfering Signal Settings", on page 300 for description of the corresponding settings.

## 8.8.7 Test Case 7.5A: Adjacent Channel Selectivity (ACS)

### Test Purpose

To verify the ability of the BS receiver filter to suppress interfering signals in the channels adjacent to the wanted channel [6].

### Required Options

- See chapter 8.2, "Basic Configuration", on page 273.
- Option Second RF path (R&S SMW-B20x)
- Second Option Baseband Generator (R&S SMW-B10)
- Option Baseband Main Module (R&S SMW-B13T)
- Second Option Digital Standard EUTRA/LTE (R&S SMW-K55)

### Test Setup

See chapter 8.4.2, "Standard Test Setup - Two Paths", on page 276

### Short Description

The Adjacent Channel Selectivity (ACS) is a test case intended to verifies that a BS receiver is able to demodulate a "weak" useful signal being superimposed by a "strong" interfering signal in the adjacent channel.

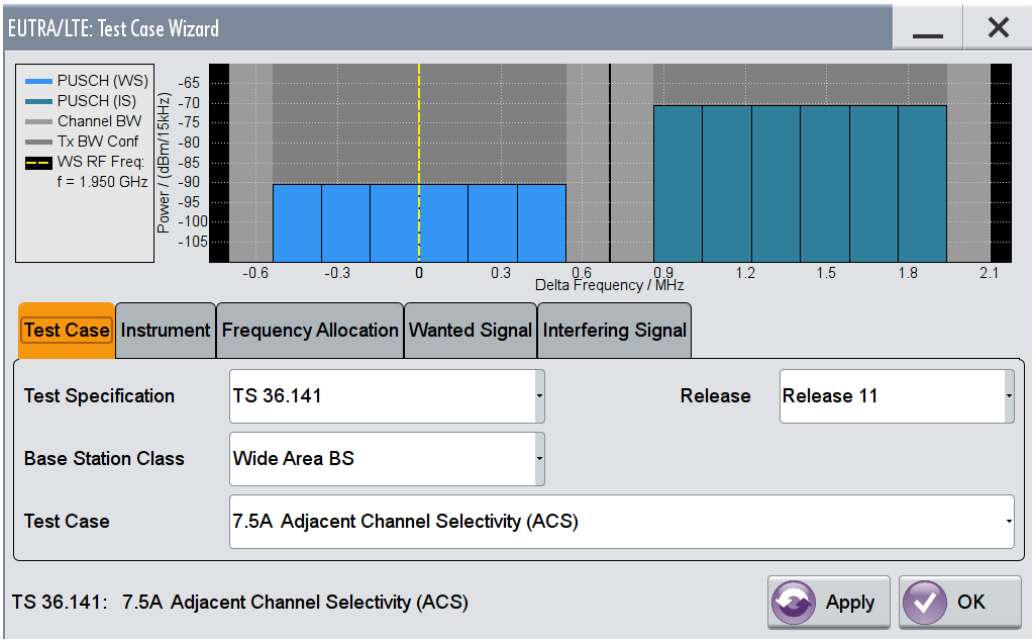
The wanted signal is a reference measurement channel FRC A1. The interfering signal shall be an EUTRA/LTE signal with the same bandwidth as the wanted signal, but at the most 5 MHz and a specified center frequency offset (see figure 8-8). The test shall be done on three channels (B, M and T).

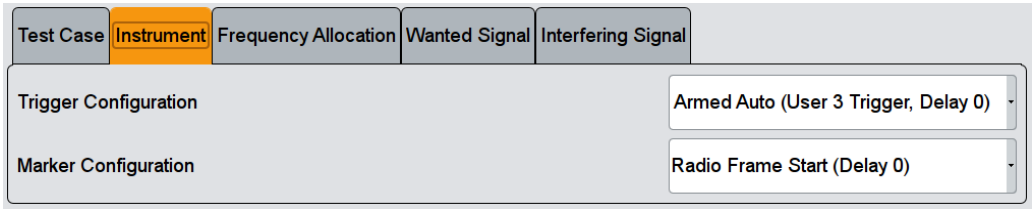
For the parameter in the table 8-12 the throughput shall be equal or grater than 95%.

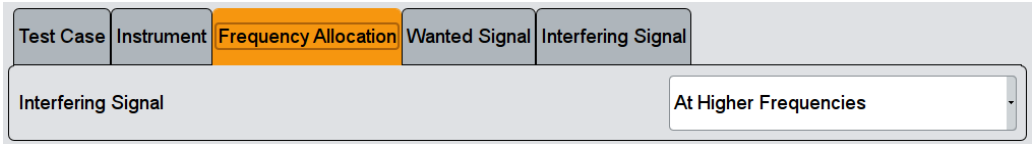
***Table 8-12: Adjacent channel selectivity***

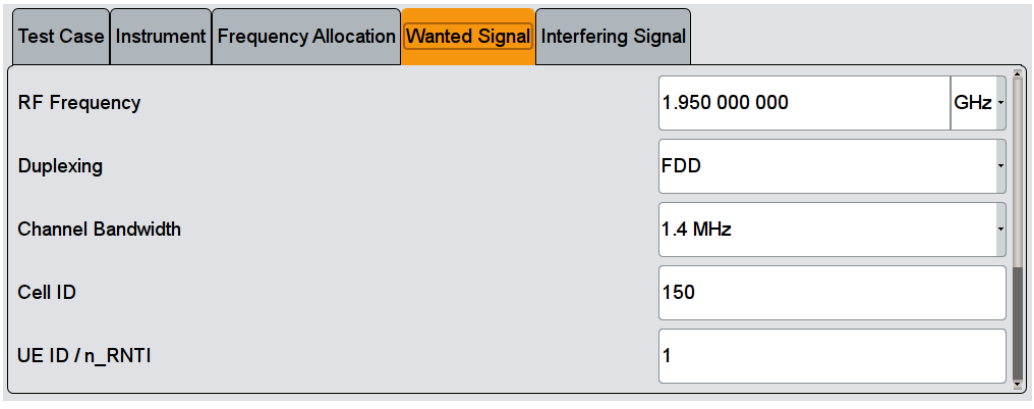
| Channel Bandwidth, MHz | Wanted signal mean power, dBm | Interfering signal mean power, dBm | Interfering signal center frequency offset from the channel edge of the wanted signal, MHz | Type of interfering signal |
|---|---|---|---|---|
| 1.4 | $P_{REFSENS}$ + 11dB | -52 | 0.7025 | 1.4 MHz EUTRA signal, 3 RBs |
| 3 | $P_{REFSENS}$ + 8dB | -52 | 1.5075 | 3 MHz EUTRA signal, 6 RBs |
| 5 | $P_{REFSENS}$ + 6dB | -52 | 2.5025 | 5 MHz EUTRA signal, 10 RBs |
| 10 | $P_{REFSENS}$ + 6dB | -52 | 2.5075 | 10 MHz EUTRA signal, 25 RBs |
| 15 | $P_{REFSENS}$ + 6dB | -52 | 2.5125 | 15 MHz EUTRA signal, 25 RBs |
| 20 | $P_{REFSENS}$ + 6dB | -52 | 2.5025 | 20 MHz EUTRA signal, 25 RBs |

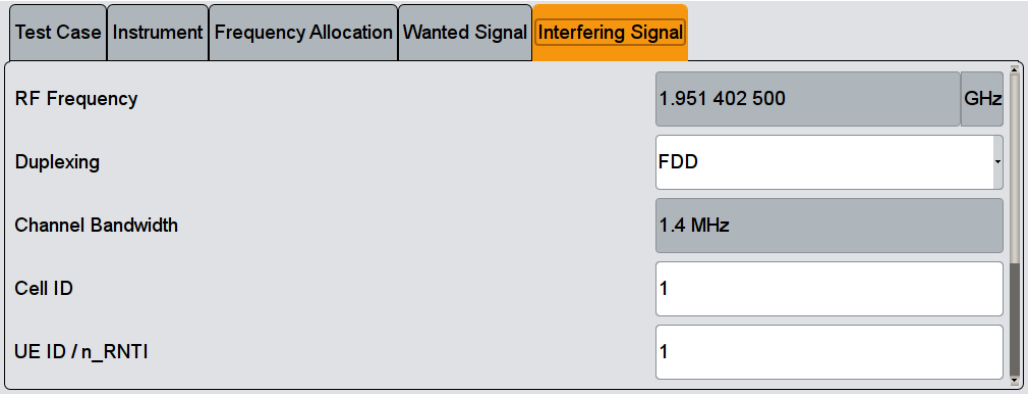
$P_{REFSENS}$ depends on the channel bandwidth as specified in TS 36.104 [9], subclause 7.2.1 (see table 8-8).


EUTRA/LTE: Test Case Wizard
PUSCH (WS)
PUSCH (IS)
Channel BW
Tx BW Conf
WS RF Freq:
f = 1.950 GHz
Power / (dBm/15kHz)
-65
-70
-75
-80
-85
-90
-95
-100
-105
-0.6
-0.3
0
0.3
0.6
0.9
1.2
1.5
1.8
2.1
Delta Frequency / MHz
Test Case
Instrument
Frequency Allocation
Wanted Signal
Interfering Signal
Test Specification
TS 36.141
Release
Release 11
Base Station Class
Wide Area BS
Test Case
7.5A Adjacent Channel Selectivity (ACS)
TS 36.141: 7.5A Adjacent Channel Selectivity (ACS)
Apply
OK


Test Case
Instrument
Frequency Allocation
Wanted Signal
Interfering Signal
Trigger Configuration
Armed Auto (User 3 Trigger, Delay 0)
Marker Configuration
Radio Frame Start (Delay 0)


Test Case
Instrument
Frequency Allocation
Wanted Signal
Interfering Signal
Interfering Signal
At Higher Frequencies


Test Case
Instrument
Frequency Allocation
Wanted Signal
Interfering Signal
RF Frequency
1.950 000 000
GHz
Duplexing
FDD
Channel Bandwidth
1.4 MHz
Cell ID
150
UE ID / n_RNTI
1




The general and instrument related settings are described in Test Case Settings and Instrument Settings

The settings of the wanted signal are described in chapter 8.6.4, "Wanted Signal and Cell Specific Settings", on page 287.

Refer to chapter 8.8.3, "Interfering Signal Settings", on page 300 for description of the corresponding settings.

## 8.8.8 Test Case 7.5B: Narrow-band blocking

### Test Purpose

To verify the ability of the BS receiver filter to suppress interfering signals in the channels adjacent to the wanted channel [6].

### Required Options

- See chapter 8.2, "Basic Configuration", on page 273.
- Option Second RF path (R&S SMW-B20x)
- Second Option Baseband Generator (R&S SMW-B10)
- Option Baseband Main Module (R&S SMW-B13T)
- Second Option Digital Standard EUTRA/LTE (R&S SMW-K55)

### Test Setup

See chapter 8.4.2, "Standard Test Setup - Two Paths", on page 276

### Short Description

The Narrow-band Blocking is a test case intended to verifies that a BS receiver is able to demodulate a "weak" useful signal being superimposed by a "strong" narrow-band interfering signal in the adjacent channel. The wanted signal is a reference measurement channel FRC A1. The interfering signal is a single resource block EUTRA/LTE signal in a channel with the same bandwidth as the wanted signal, but at the most 5 MHz. The interfering signal is located at a specified center frequency offset and adjacently to the channel edge of the wanted signal (see figure 8-10).

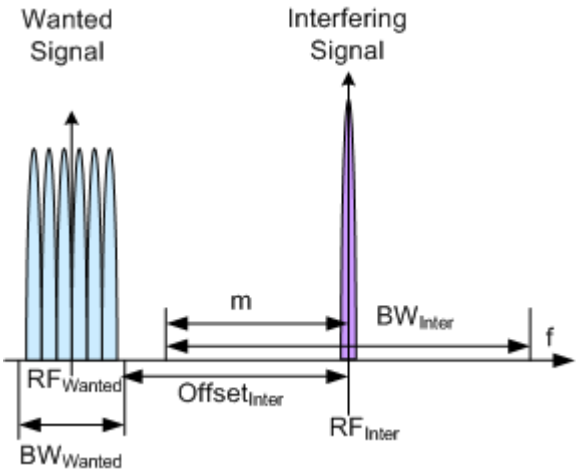



*Fig. 8-10: Example: Narrow-band Blocking*

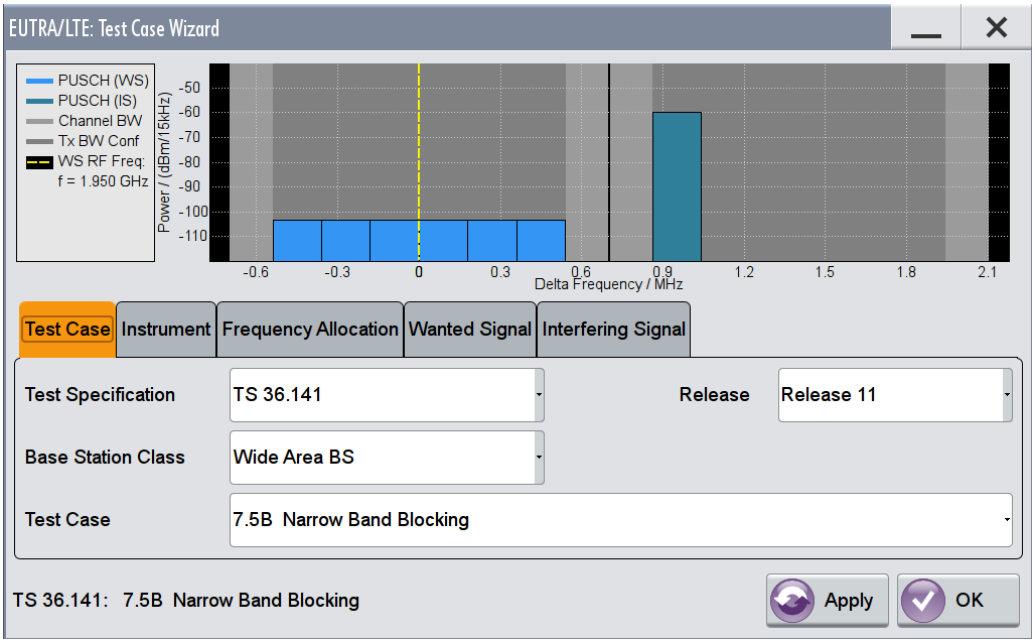
The test shall be done on three channels (B, M and T).

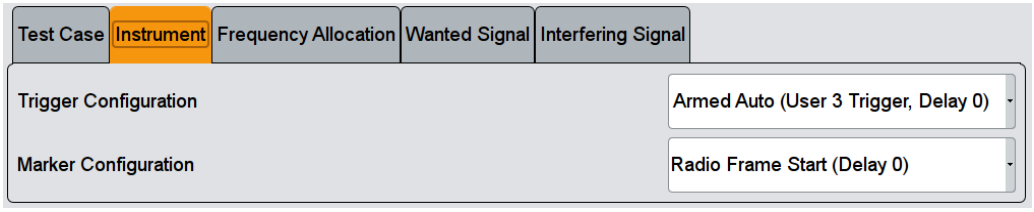
For the parameter in the table 8-13 the throughput shall be equal or grater than 95%.

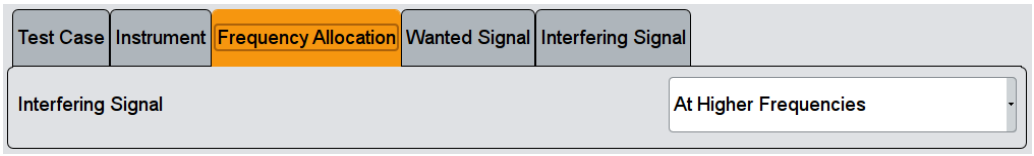
*Table 8-13: Interfering signal for Narrowband blocking requirement*

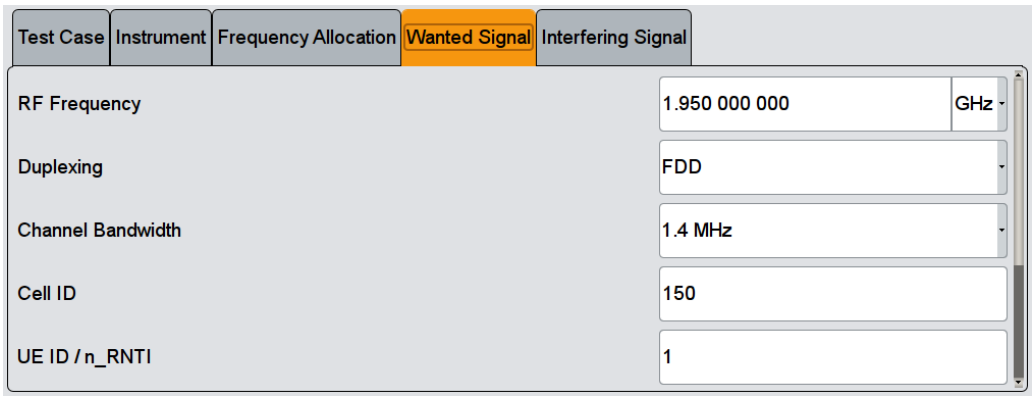
| Channel Bandwidth, MHz | Wanted signal mean power, dBm | Interfering signal mean power, dBm | Interfering RB center frequency offset to the channel edge of the wanted signal, kHz | Type of interfering signal |
|---|---|---|---|---|
| 1.4 | $P_{REFSENS}$ + 6dB | -49 | 252.5+m*180,<br>m=0, 1, 2, 3, 4, 5 | 1.4 MHz EUTRA signal, 1 RB |
| 3 | | | 247.5+m*180,<br>m=0, 1, 2, 3, 4, 7, 10, 13 | 3 MHz EUTRA signal, 1 RB |
| 5 / 10 / 15 / 20 | | | 342.5+m*180,<br>m=0, 1, 2, 3, 4, 9, 14, 19, 24 | 5 MHz EUTRA signal, 1 RB |

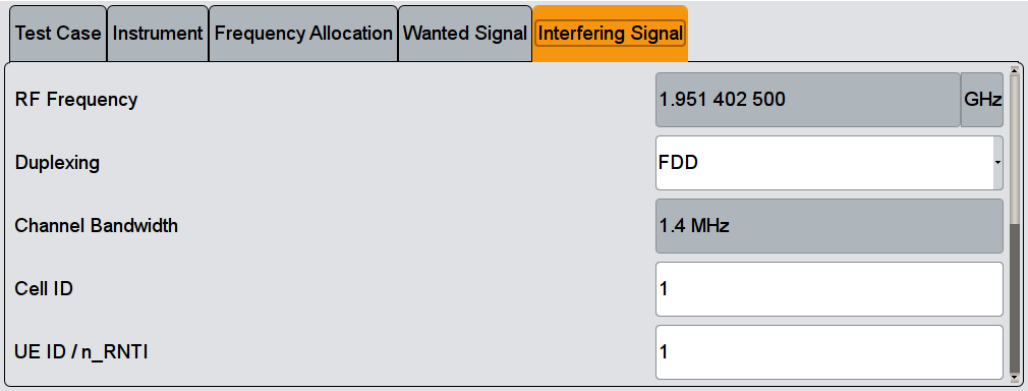
$P_{REFSENS}$ depends on the channel bandwidth as specified in TS 36.104 [9], subclause 7.2.1 (see table 8-8).


EUTRA/LTE: Test Case Wizard
PUSCH (WS)
PUSCH (IS)
Channel BW
Tx BW Conf
WS RF Freq:
f = 1.950 GHz
Power / (dBm/15kHz)
-50
-60
-70
-80
-90
-100
-110
-0.6
-0.3
0
0.3
0.6
0.9
1.2
1.5
1.8
2.1
Delta Frequency / MHz
Test Case
Instrument
Frequency Allocation
Wanted Signal
Interfering Signal
Test Specification
TS 36.141
Release
Release 11
Base Station Class
Wide Area BS
Test Case
7.5B Narrow Band Blocking
TS 36.141: 7.5B Narrow Band Blocking
Apply
OK


Test Case
Instrument
Frequency Allocation
Wanted Signal
Interfering Signal
Trigger Configuration
Armed Auto (User 3 Trigger, Delay 0)
Marker Configuration
Radio Frame Start (Delay 0)


Test Case
Instrument
Frequency Allocation
Wanted Signal
Interfering Signal
Interfering Signal
At Higher Frequencies


Test Case
Instrument
Frequency Allocation
Wanted Signal
Interfering Signal
RF Frequency
1.950 000 000
GHz
Duplexing
FDD
Channel Bandwidth
1.4 MHz
Cell ID
150
UE ID / n_RNTI
1




The general and instrument related settings are described in Test Case Settings and Instrument Settings

The settings of the wanted signal are described in chapter 8.6.4, "Wanted Signal and Cell Specific Settings", on page 287.

Refer to chapter 8.8.3, "Interfering Signal Settings", on page 300 for description of the corresponding settings.

### 8.8.9 Test Case 7.6: Blocking

#### Test Purpose

The test stresses the ability of the BS receiver to withstand high-level interference from unwanted signals at specified frequency offsets without undue degradation of its sensitivity [6].

#### Required Options

The following options are sufficient for tests with **CW interfering signal**:

- See chapter 8.2, "Basic Configuration", on page 273.
- Option Second RF path (R&S SMW-B20x)

Additionaly, the following options are necessary for tests with **LTE interfering signal**:

- Second Option Baseband Generator (R&S SMW-B10)
- Option Baseband Main Module (R&S SMW-B13T)
- Second Option Digital Standard EUTRA/LTE (R&S SMW-K55)

#### Test Setup

The blocking test using a EUTRA/LTE interfering signal can be performed with one instrument, see chapter 8.4.2, "Standard Test Setup - Two Paths", on page 276. This setup can also be used for the CW interfering signal case but only for the CW signals with up to 3 GHz or 6 GHz carrier, depending on the installed option. For tests with CW with frequency greater than 6 GHz a second signal generator is necessary, like R&S SMF for instance.

### Short Description

The blocking characteristics is a test case that verifies the ability of the receiver to demodulate a wanted signal in the presence of a strong interfering signal. The test is split into two scenarios:

- Test of in-band blocking, performed with an LTE interfering signal inside the operating band (seetable 8-4 ), but not adjacent to the wanted signal.
- Test of out-of-band blocking, performed with a CW interfering signal with 1 MHz up to 12.750 GHz.
  There is an additional (optional) blocking requirements for co-location with other base station.

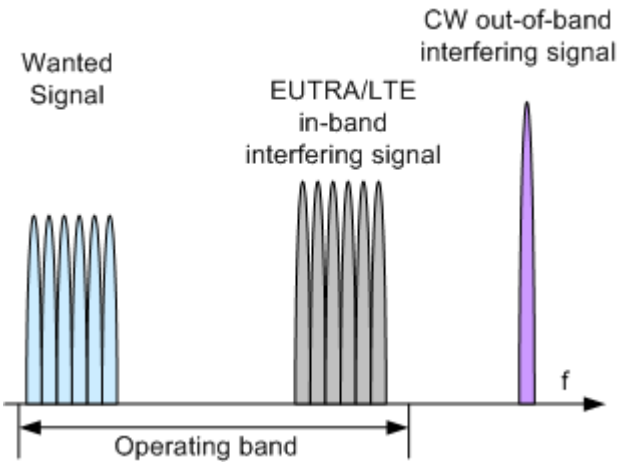



*Fig. 8-11: Example: Blocking*

The test shall be done on one channel (M).

For the parameter in the table 8-14 the throughput shall be equal or grater than 95%.

*Table 8-14: Blocking performance requirement*

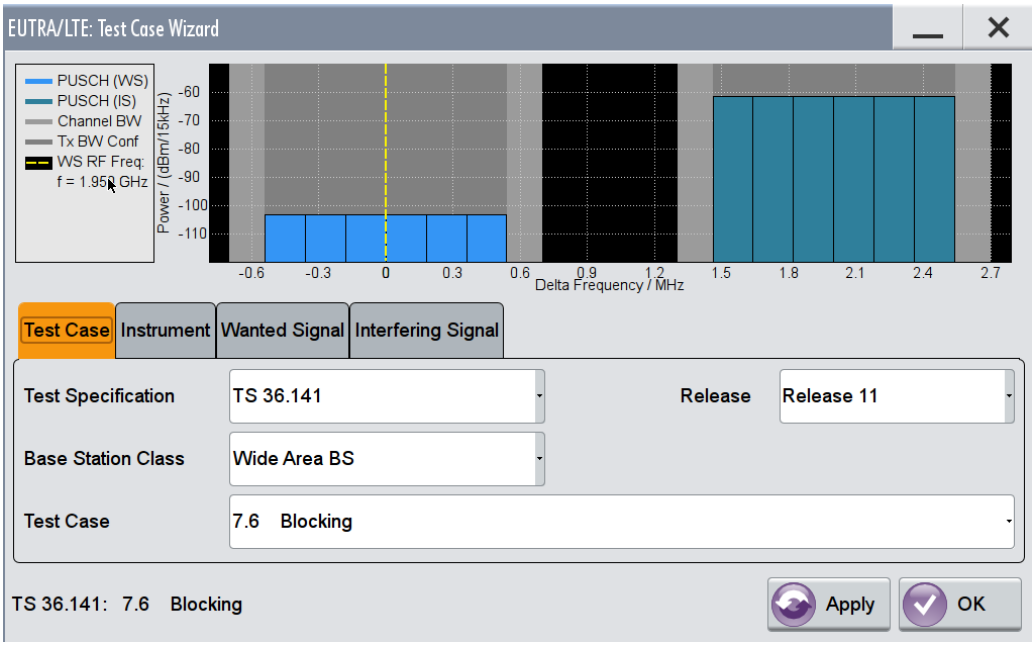
| Operating Band | Center Frequency of Interfering Signal, MHz | Interfering Signal mean power, dBm | Wanted Signal mean power, dBm | Type of Interfering Signal |
|---|---|---|---|---|
| 1-7, 9-11, 13-14, 33-40 | ($F_{UL\_low}$ - 20) to ($F_{UL\_high}$ + 20) | -43 | $P_{REFSENS}$ + 6dB | EUTRA/LTE* |
| | 1 to ($F_{UL\_low}$ - 20)<br>($F_{UL\_high}$ + 20) to 12750 | -15 | $P_{REFSENS}$ + 6dB | CW |
| 8 | ($F_{UL\_low}$ - 20) to ($F_{UL\_high}$ + 10) | -43 | $P_{REFSENS}$ + 6dB | EUTRA/LTE* |
| | 1 to ($F_{UL\_low}$ - 20)<br>($F_{UL\_high}$ + 10) to 12750 | -15 | $P_{REFSENS}$ + 6dB | CW |
| 12 | ($F_{UL\_low}$ - 20) to ($F_{UL\_high}$ + 12) | -43 | $P_{REFSENS}$ + 6dB | EUTRA/LTE* |
| | 1 to ($F_{UL\_low}$ - 20)<br>($F_{UL\_high}$ + 12) to 12750 | -15 | $P_{REFSENS}$ + 6dB | CW |
| | *) see table 8-15 | | | |

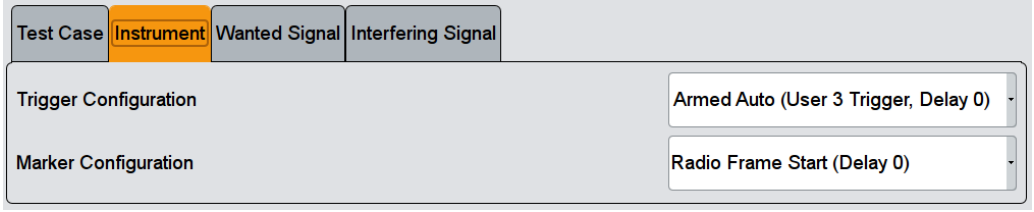
| Operating Band | Center Frequency of Interfering Signal, MHz | Interfering Signal mean power, dBm | Wanted Signal mean power, dBm | Type of Interfering Signal |
|---|---|---|---|---|
| 17 | ($F_{UL\_low}$ - 20) to ($F_{UL\_high}$ + 18) | -43 | $P_{REFSENS}$ + 6dB | EUTRA/LTE* |
| | 1 to ($F_{UL\_low}$ - 20)<br>($F_{UL\_high}$ + 18) to 12750 | -15 | $P_{REFSENS}$ + 6dB | CW |
| | *) see table 8-15 | | | |

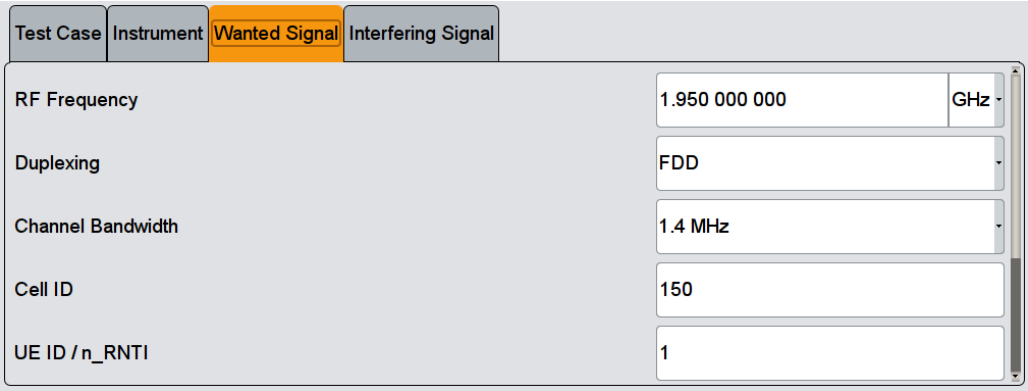
***Table 8-15: EUTRA/LTE interfering signals for Blocking performance requirement***

| Channel Bandwidth, MHz | Interfering signal center frequency minimum offset to the channel edge of the wanted signal, MHz | Type of interfering signal |
|---|---|---|
| 1.4 | 2.1 | 1.4 MHz EUTRA signal |
| 3 | 4.5 | 3 MHz EUTRA signal |
| 5 / 10 / 15 / 20 | 7.5 | 5 MHz EUTRA signal |

$P_{REFSENS}$ depends on the channel bandwidth as specified in TS 36.104 [9], subclause 7.2.1 (see table 8-8).



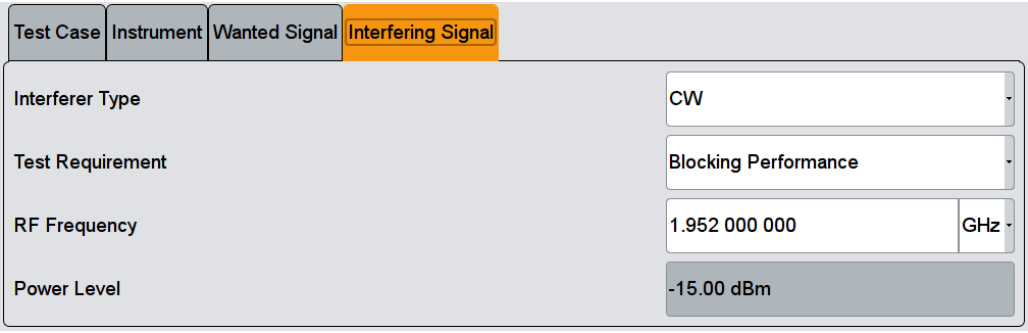



The general and instrument related settings are described in Test Case Settings and Instrument Settings

The settings of the wanted signal are described in chapter 8.6.4, "Wanted Signal and Cell Specific Settings", on page 287.

**Interfering Signal**

The common settings of the interfering signal are described in chapter 8.8.3, "Interfering Signal Settings", on page 300.




**Test Requirement**

For CW interfering signal, selects whether the standard out-of-band blocking requirements test is performed or the optional blocking scenario, when the BS is co-located with another BS in a different operating band.

Remote command:

`[:SOURce<hw>]:BB:EUTRa:TCW:IS:TREQuire` on page 548

## 8.8.10 Test Case 7.8: Receiver intermodulation

**Test Purpose**

The test purpose is to verify the ability of the BS receiver to inhibit the generation of intermodulation products in its non-linear elements caused by the presence of two high-level interfering signals at frequencies with a specific relationship to the frequency of the wanted signal [6].

### Required Options

- See chapter 8.2, "Basic Configuration", on page 273.
- Option Additive White Gaussian Noise AWGN (R&S SMW-K62)
- Option Second RF path (R&S SMW-B20x)
- Second Option Baseband Generator (R&S SMW-B10)
- Option Baseband Main Module (R&S SMW-B13T)
- Second Option Digital Standard EUTRA/LTE (R&S SMW-K55)

### Test Setup

See chapter 8.4.2, "Standard Test Setup - Two Paths", on page 276.

### Short Description

The receiver intermodulation test is a test scenario with two interfering signals, one CW and one EUTRA/LTE signal. The center frequency of the interfering signals is selected so that the third and higher order mixing products falls inside of the band of the wanted signal. There is also a second narrow-band intermodulation scenarios defined, where the EUTRA/LTE interfering signal is a narrow-band signal with single resource block allocation and the CW interfering signal is placed very close to the wanted one.

The test shall be done on three channels (B, M and T).

For the parameter in the table 8-16 and table 8-17 the throughput shall be equal or grater than 95%.

*Table 8-16: Intermodulation performance requirement*

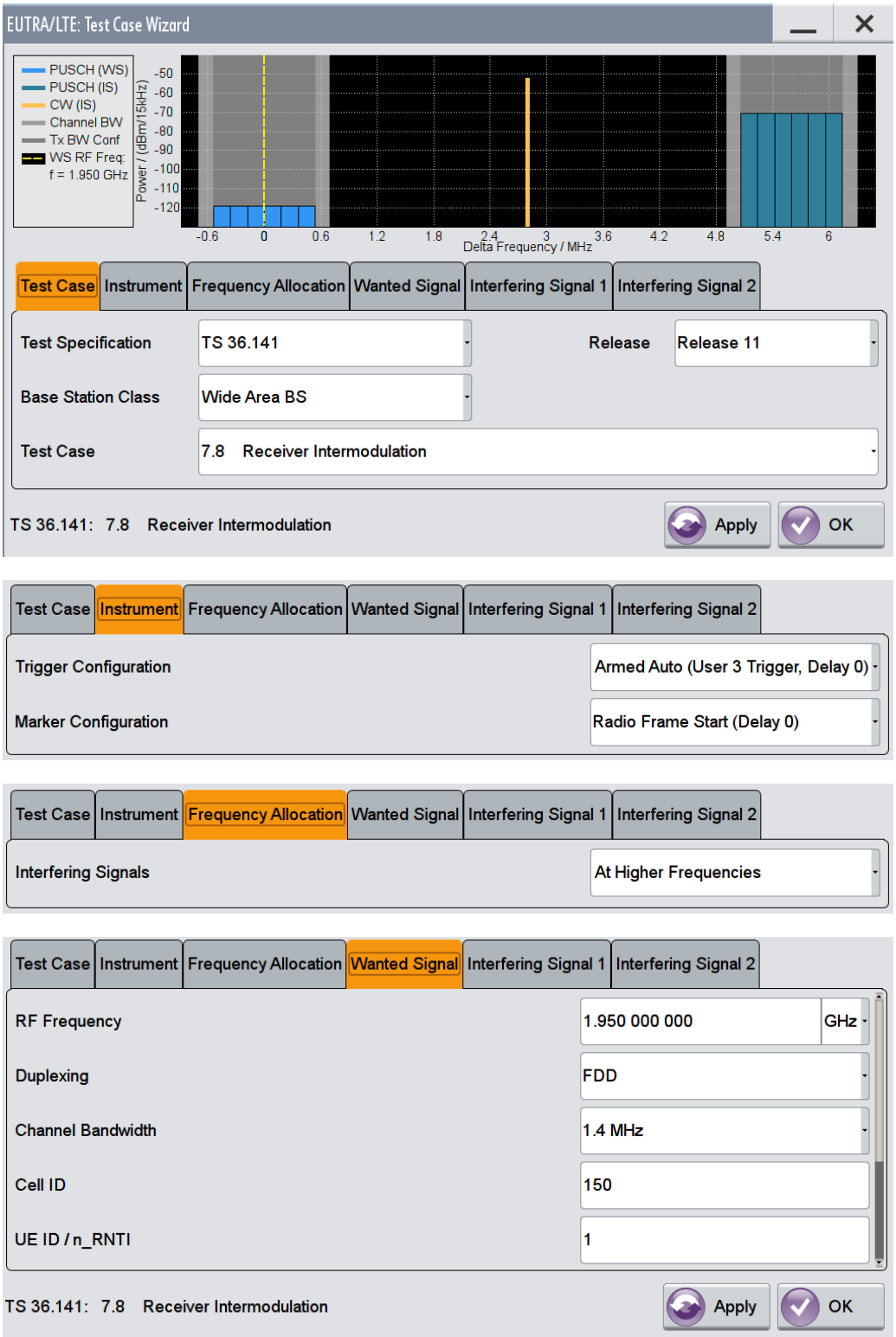
| Channel Bandwidth, MHz | Wanted signal mean power, dBm | Interfering signal mean power, dBm | Interfering signal center frequency offset from the channel edge of the wanted signal, MHz | Type of interfering signal |
|---|---|---|---|---|
| 1.4 | $P_{REFSENS}$ + 6dB | -52 | 2.1 | CW |
| | $P_{REFSENS}$ + 6dB | -52 | 4.9 | 1.4 MHz EUTRA signal |
| 3 | $P_{REFSENS}$ + 6dB | -52 | 4.5 | CW |
| | $P_{REFSENS}$ + 6dB | -52 | 10.5 | 3 MHz EUTRA signal |
| 5 | $P_{REFSENS}$ + 6dB | -52 | 7.5 | CW |
| | $P_{REFSENS}$ + 6dB | -52 | 17.5 | 5 MHz EUTRA signal |
| 10 | $P_{REFSENS}$ + 6dB | -52 | 7.5 | CW |
| | $P_{REFSENS}$ + 6dB | -52 | 17.7 | 5 MHz EUTRA signal |
| 15 | $P_{REFSENS}$ + 6dB | -52 | 7.5 | CW |

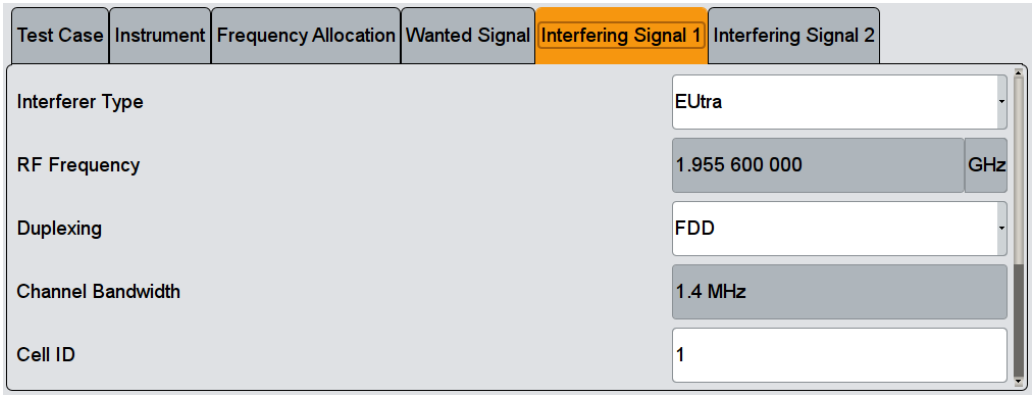
| Channel Bandwidth, MHz | Wanted signal mean power, dBm | Interfering signal mean power, dBm | Interfering signal center frequency offset from the channel edge of the wanted signal, MHz | Type of interfering signal |
|---|---|---|---|---|
| | $P_{REFSENS}$ + 6dB | -52 | 18 | 5 MHz EUTRA signal |
| 20 | $P_{REFSENS}$ + 6dB | -52 | 7.5 | CW |
| | $P_{REFSENS}$ + 6dB | -52 | 18.2 | 5 MHz EUTRA signal |

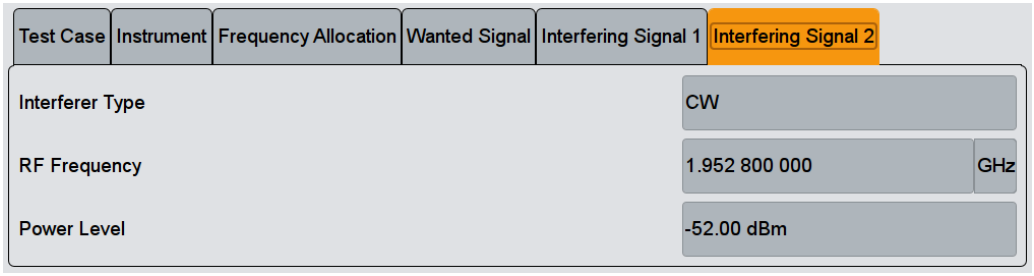
*Table 8-17: Narrow-band intermodulation performance requirement*

| Channel Bandwidth, MHz | Wanted signal mean power, dBm | Interfering signal mean power, dBm | Interfering signal center frequency offset from the channel edge of the wanted signal, kHz | Type of interfering signal |
|---|---|---|---|---|
| 1.4 | $P_{REFSENS}$ + 6dB | -52 | 270 | CW |
| | $P_{REFSENS}$ + 6dB | -52 | 790 | 1.4 MHz EUTRA signal, 1 RB |
| 3 | $P_{REFSENS}$ + 6dB | -52 | 275 | CW |
| | $P_{REFSENS}$ + 6dB | -52 | 790 | 3 MHz EUTRA signal, 1 RB |
| 5 | $P_{REFSENS}$ + 6dB | -52 | 360 | CW |
| | $P_{REFSENS}$ + 6dB | -52 | 1060 | 5 MHz EUTRA signal, 1 RB |
| 10 | $P_{REFSENS}$ + 6dB | -52 | 415 | CW |
| | $P_{REFSENS}$ + 6dB | -52 | 1420 | 5 MHz EUTRA signal, 1 RB |
| 15 | $P_{REFSENS}$ + 6dB | -52 | 380 | CW |
| | $P_{REFSENS}$ + 6dB | -52 | 1600 | 5 MHz EUTRA signal, 1 RB |
| 20 | $P_{REFSENS}$ + 6dB | -52 | 345 | CW |
| | $P_{REFSENS}$ + 6dB | -52 | 1780 | 5 MHz EUTRA signal, 1 RB |

$P_{REFSENS}$ depends on the channel bandwidth as specified in TS 36.104 [9], subclause 7.2.1 (see table 8-8).


EUTRA/LTE: Test Case Wizard
PUSCH (WS)
PUSCH (IS)
CW (IS)
Channel BW
Tx BW Conf
WS RF Freq:
f = 1.950 GHz
Power / (dBm/15kHz)
-50
-60
-70
-80
-90
-100
-110
-120
-0.6
0
0.6
1.2
1.8
2.4
3
3.6
4.2
4.8
5.4
6
Delta Frequency / MHz
Test Case
Instrument
Frequency Allocation
Wanted Signal
Interfering Signal 1
Interfering Signal 2
Test Specification
TS 36.141
Release
Release 11
Base Station Class
Wide Area BS
Test Case
7.8 Receiver Intermodulation
TS 36.141: 7.8 Receiver Intermodulation
Apply
OK
Test Case
Instrument
Frequency Allocation
Wanted Signal
Interfering Signal 1
Interfering Signal 2
Trigger Configuration
Armed Auto (User 3 Trigger, Delay 0)
Marker Configuration
Radio Frame Start (Delay 0)
Test Case
Instrument
Frequency Allocation
Wanted Signal
Interfering Signal 1
Interfering Signal 2
Interfering Signals
At Higher Frequencies
Test Case
Instrument
Frequency Allocation
Wanted Signal
Interfering Signal 1
Interfering Signal 2
RF Frequency
1.950 000 000
GHz
Duplexing
FDD
Channel Bandwidth
1.4 MHz
Cell ID
150
UE ID / n_RNTI
1
TS 36.141: 7.8 Receiver Intermodulation
Apply
OK




The general and instrument related settings are described in Test Case Settings and Instrument Settings

The settings of the wanted signal are described in chapter 8.6.4, "Wanted Signal and Cell Specific Settings", on page 287.

Refer to chapter 8.8.3, "Interfering Signal Settings", on page 300 for description of the corresponding settings.

## 8.9 Performance Requirements (TS 36.141, Chapter 8)

The BS RF performance requirements are divided into three main groups:

- Performance requirements for PUSCH, see
  - chapter 8.9.3, "Test Case 8.2.1: PUSCH in multipath fading propagation conditions", on page 329
  - chapter 8.9.4, "Test Case 8.2.2: UL timing adjustment", on page 332
  - chapter 8.9.5, "Test Case 8.2.3: HARQ-ACK multiplexed on PUSCH", on page 338
  - chapter 8.9.6, "Test Case 8.2.4: High Speed Train conditions", on page 340
- Performance requirements for PUCCH
  - chapter 8.9.7, "Test Case 8.3.1: ACK missed detection for single user PUCCH format 1a", on page 345
  - chapter 8.9.8, "Test Case 8.3.2: CQI performance requirements for PUCCH format 2", on page 347
  - chapter 8.9.9, "Test Case 8.3.3: ACK missed detection for multi user PUCCH format 1a", on page 349

- Performance requirements for PRACH
  – chapter 8.9.14, "Test Case 8.4.1: PRACH false alarm probability and missed detection", on page 364

## 8.9.1 Prior Considerations

### Fixed Reference Channels (FRC)

The receiver tests use fixed reference channels (FRC) as defined in 3GPP TS 36.141, Annex A "Reference Measurement channels".

The following FRCs are defined for the performance tests:

- FRC A3: A3-1 .. A3-7 (QPSK)
- FRC A4: A4-1 .. A4-8 (16QAM)
- FRC A5: A5-1 .. A5-7 (64QAM)
- FRC A7: A7-1 .. A7-6 (16QAM for UL timing adjustment)
- FRC A8: A8-1 .. A8-6 (QPSK for UL timing adjustment)

Refer to table 7-12 for an overview of all supported FRC.

### Channels

According to the TS 36.141, the channels to test are located in the bottom (B), middle (M) and the top (T) of the supported frequency range of the base station. See table 8-4 for an overview of the supported frequency operating bands.

### Power Settings

The "Level Reference" parameter in the "Filter/Clipping/Power Settings" dialog is automatically set to "UL Part of Frame RMS Power".

### Filter Settings

The 3GPP EUTRA/LTE specifications do not define a standardized transmit filter neither for the UE nor for the base station. Therefore, when a test case is activated, a filter type EUTRA/LTE with "Best EVM Optimization" is automatically selected.

### AWGN Power Level

The performance requirements tests are performed for a given SNR where the AWGN power level is determined per channel bandwidth and test case according to table 8-18.

*Table 8-18: AWGN power level*

| Channel bandwidth, MHz | AWGN power level PUSCH tests | AWGN power level PUCCH and PRACH tests |
|---|---|---|
| 1.4 | -92.7 dBm / 1.08 MHz | -98.7 dBm / 1.08 MHz |
| 3 | -88.7 dBm / 2.7 MHz | -85.7 dBm / 2.7 MHz |
| 5 | -86.5 dBm / 4.5 MHz | -83.5 dBm / 4.5 MHz |
| 10 | -83.5 dBm / 9 MHz | -80.5 dBm / 9 MHz |
| 15 | -81.7 dBm / 13.5 MHz | -78.7 dBm / 13.5 MHz |
| 20 | -80.4 dBm / 18 MHz | -77.4 dBm / 18 MHz |

### SNR Correction Factor

The SNR correction factor is applied for **FRCs with not fully allocated RBs** and is calculated as follow:

$SNR_{CorrectionFactor}=10*log_{10}(\#Allocated\ RBs/\#Possible\ RBs)$, dB

*Table 8-19: SNR Correction Factor*

| Channel Bandwidth, MHz | #Possible RBs | $SNR_{CorrectionFactor}$, dB for FRC A3-1, A4-1, A4-2 and A5-1 with 1 allocated RB | $SNR_{CorrectionFactor}$, dB PRACH Burst Format 0..3 | $SNR_{CorrectionFactor}$, dB PRACH Burst Format 4 |
|---|---|---|---|---|
| 1.4 | 6 | -7.78 | -0.13 | -0.15 |
| 3 | 15 | -11.76 | -4.11 | -4.13 |
| 5 | 25 | -13.98 | -6.33 | -6.35 |
| 10 | 50 | -16.99 | -9.34 | -9.36 |
| 15 | 75 | -18.75 | -11.10 | -11.13 |
| 20 | 100 | -20.00 | -12.34 | -12.37 |

The wanted signal power level is calculated according to the following formula:

$Power\ Level_{WantedSignal} = Power\ Level_{AWGN} + SNR + SNR_{CorrectionFactor}$

**Example: Test Case 8.2.1**

"Channel Bandwidth" = 1.4 MHz

"Number of Rx Antennas" = 2

"Cyclic Prefix" = Normal

"Propagation Conditions" = EVA 5Hz

"FRC" = A3-1

"Fraction of maximum throughput" = 30%

According to table 8-21 the SNR = -2.1 dB

According to table 8-19 the $SNR_{CorrectionFactor}$ = -7.78 dB

According to table 8-18 the Power $Level_{AWGN}$ = -92.7 dBm

Power $Level_{WantedSignal}$ = Power $Level_{AWGN}$ + SNR + $SNR_{CorrectionFactor}$ = -92.7 - 2.1 - 7.78 = -102.6 dB

**HARQ-Feedback**

Some of the performance requirements test cases require a feedback signal from the base station. The R&S SMW equipped with the option R&S SMW-K69 is able to perform HARQ retransmissions and/or timing shifts according to the 3GPP specification.

Refer to chapter 6, "Realtime Feedback for Closed Loop BS Tests", on page 62 for explanation of the scope of this feature as well as for detailed description of the different feedback modes.

## 8.9.2 Realtime Feedback Configuration, AWGN and Propagation Condition Settings

**Realtime Feedback Configuration**
Comprises the settings of the realtime feedback message and the feedback line.

**Realtime Feedback Mode ← Realtime Feedback Configuration**
Determines the feedback mode.

| | |
|---|---|
| "Binary ACK/ NACK" | The ACK/NACK feedback is implemented as low/high voltage level on the feedback line connector.<br>Timing Adjustments Feedback is not supported in this mode. |
| "Serial" | ACK/NACK Feedback and Timing Adjustments Feedback are implemented by means of a serial protocol (see chapter 6.2.2, "Serial Mode", on page 64). |
| "Serial 3x8" | ACK/NACK Feedback and Timing Adjustments Feedback are implemented by means of serial commands, consisting of three serial packets (see chapter 6.2.3, "Serial 3x8 Mode", on page 64). |

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:RTF:MODE` on page 550

**Connector ← Realtime Feedback Configuration**
Determines the feedback line connector.

"Global (User 6)"
The following settings apply:
- "EUTRA/LTE > User Equipment > Realtime Feedback > Connector > Global"
- "Global Connector Settings > User 6 > Direction > Input" and "User 6 > Signal > Feedback"

"Local (TM3)"
The following settings apply:
- "EUTRA/LTE > User Equipment > Realtime Feedback > Connector > Local"
- "Local Connector Settings > T/M 3 > Direction > Input" and "T/M 3 > Signal > Feedback"

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:RTF:CONNector` on page 549

**Additional User Delay ← Realtime Feedback Configuration**
Determines the point in time when the feedback can be sent to the instrument.

For more information see chapter 6.3, "Timing Aspects", on page 68.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:RTF:AUSDelay` on page 549

**Baseband Selector ← Realtime Feedback Configuration**
("Serial" and "Serial 3x8" mode only)

This parameter is required for multiplexing serial commands for different baseband units to one feedback line. If the selector n is configured in the GUI for a specific baseband unit, the baseband unit will listen only to serial commands containing the selector n.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:RTF:BBSelector` on page 549

**Serial Rate ← Realtime Feedback Configuration**
(Serial and Serial 3x8 mode only)

Determines the bit rate of the serial transmission. Possible rates are 115.2 kbps, 1.6 Mbps and 1.92 Mbps.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:RTF:SERRate` on page 550

**ACK Definition ← Realtime Feedback Configuration**
("Binary ACK/NACK" mode only)

Determines whether a high or a low binary level on the feedback line connector represents an ACK.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:RTF:ACKDefinition` on page 549

**AWGN Configuration**
Comprises the settings of the AWGN signal.

**Power Level ← AWGN Configuration**
Displays the AWGN power level. The value is determined according to table 8-18 by the selected channel bandwidth.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:AWGN:PLevel?` on page 541

**Propagation Conditions**
Selects a predefined multipath fading propagation conditions. The settings of the fading simulator are adjusted according to the corresponding channel model as defined in 3GPP TS 36.141, Annex B.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:WS:PROCondition` on page 555

### 8.9.3 Test Case 8.2.1: PUSCH in multipath fading propagation conditions

**Test Purpose**

The test shall verify the receiver's ability to achieve throughput under multipath fading propagation conditions for a given SNR [6].

**Required Options**

- See chapter 8.2, "Basic Configuration", on page 273.
- Option Baseband Main Module (R&S SMW-B13T)
- Frequency Options (R&S SMW-B20x)
- 2 Options Additive White Gaussian Noise AWGN (R&S SMW-K62)
- 2 or 4 Options Fading Simulator (R&S SMW-B14)
- Option LTE closed loop BS Test (R&S SMW-K69)

**Test Setup**

The test setup for PUSCH tests with two Rx antennas is performed according to chapter 8.4.3, "Test Setup - Diversity Measurements", on page 277.

The test setup with four Rx antennas requires additional instruments, see chapter 8.4.4, "Test Setup - Four Rx Antennas", on page 277 (HARQ feedback line is not required).

**Short Description**

The performance requirement of PUSCH is determined by a minimum required throughput for a given SNR. The throughput is measured by the base station under test and is expressed as a fraction of maximum throughput for the FRC's. HARQ re-transmissions are assumed.

The characteristics of the wanted signal are adjusted according to the pre-defined FRC and the test parameter given in table 8-20.

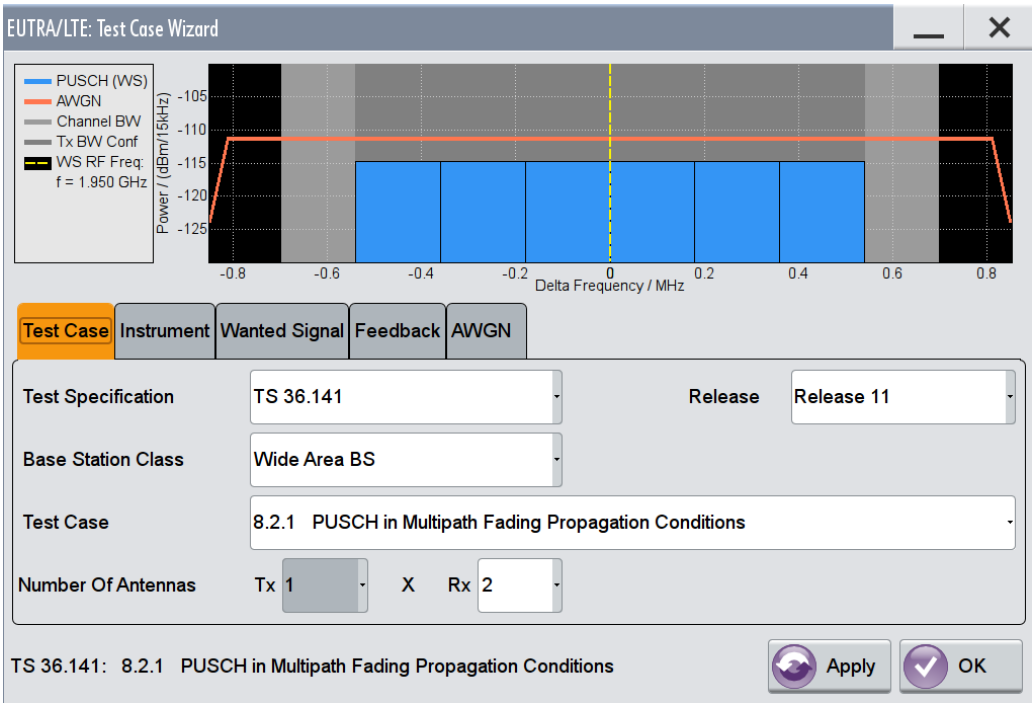
***Table 8-20: Test parameters for testing PUSCH***

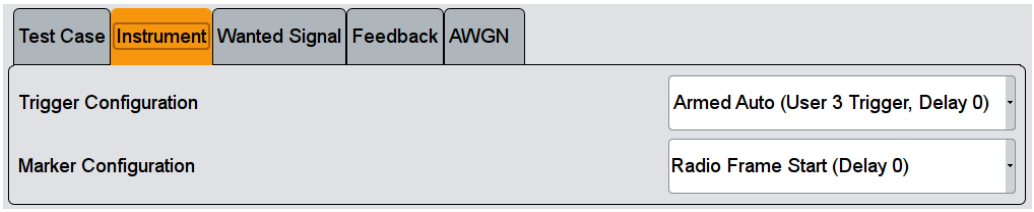
| Parameter | Value |
|---|---|
| Maximum number of HARQ transmissions | 4 |
| RV sequence | 0, 2, 3, 1, 0, 2, 3, 1 |
| Uplink-downlink allocation for TDD | Configuration 1 (2:2) |

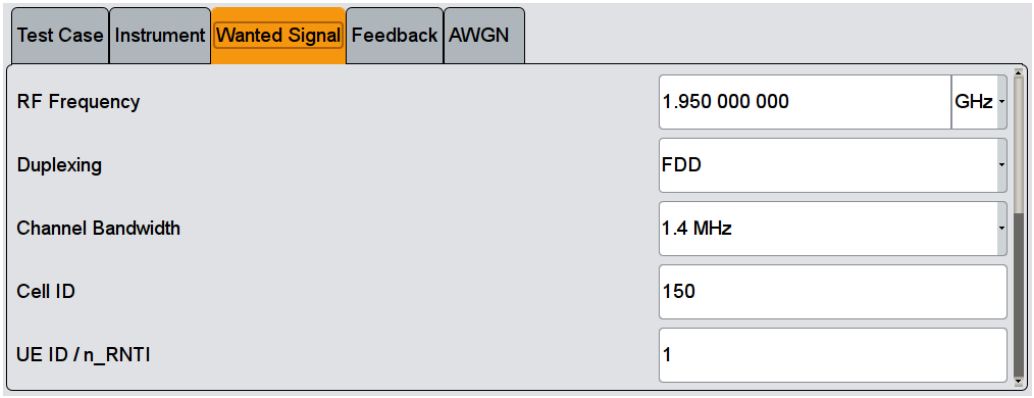
The table 8-21 shows an example of the test requirements (channel bandwidth 1.4 MHz). Similar requirements exist for the different FRCs, channel bandwidths and antenna configurations. Refer to 3GPP TS 36.141 for a detailed description of all test requirements.

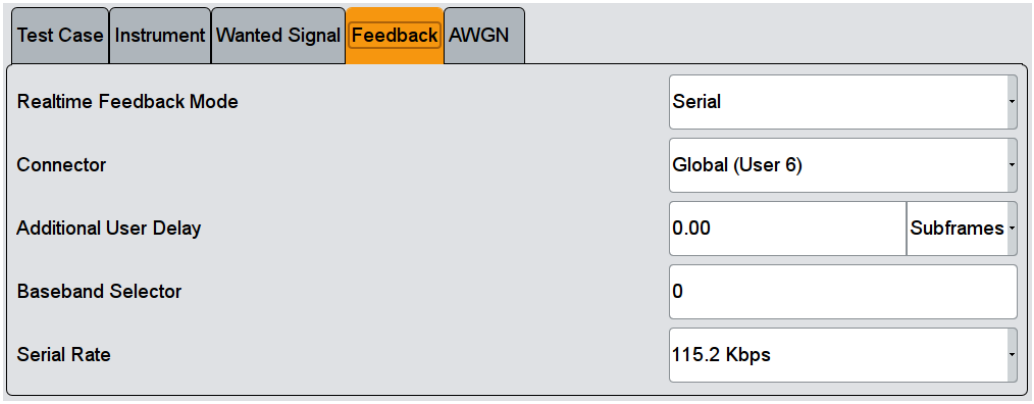
***Table 8-21: Test requirements for PUSCH, 1.4 MHz Channel Bandwidth***

| Cyclic prefix | Propagation conditions | FRC | Fraction of maximum throughput, % | SNR, dB<br>2 RX antennas | SNR, dB<br>4 RX antennas |
|---|---|---|---|---|---|
| Normal | EPA 5Hz | A3-2 | 30<br>70 | -3.5<br>0.7 | -6.0<br>-2.5 |
| | | A4-3 | 70 | 11.2 | 7.7 |
| | | A5-2 | 70 | 18.3 | 15.0 |
| | EVA 5Hz | A3-1 | 30<br>70 | -2.1<br>2.4 | -4.4<br>-0.7 |
| | | A4-1 | 30<br>70 | 5.0<br>11.9 | 1.9<br>8.4 |
| | | A5-1 | 70 | 19.2 | 16.0 |
| | EVA 70Hz | A3-2 | 30<br>70 | -3.3<br>1.3 | -5.7<br>-2.1 |
| | | A4-3 | 30<br>70 | 4.6<br>12.5 | 1.4<br>8.9 |
| | ETU 70Hz | A3-1 | 30<br>70 | -1.6<br>3.5 | -4.2<br>-0.4 |
| | ETU 300Hz | A3-1 | 30<br>70 | -1.6<br>3.5 | -4.0<br>0.0 |
| Extended | ETU 70Hz | A4-2 | 30<br>70 | 5.4<br>14.1 | 2.2<br>10.5 |


EUTRA/LTE: Test Case Wizard
PUSCH (WS)
AWGN
Channel BW
Tx BW Conf
WS RF Freq:
f = 1.950 GHz
Power / (dBm/15kHz)
-105
-110
-115
-120
-125
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
Delta Frequency / MHz
Test Case
Instrument
Wanted Signal
Feedback
AWGN
Test Specification
TS 36.141
Release
Release 11
Base Station Class
Wide Area BS
Test Case
8.2.1 PUSCH in Multipath Fading Propagation Conditions
Number Of Antennas
Tx 1
X
Rx 2
TS 36.141: 8.2.1 PUSCH in Multipath Fading Propagation Conditions
Apply
OK


Test Case
Instrument
Wanted Signal
Feedback
AWGN
Trigger Configuration
Armed Auto (User 3 Trigger, Delay 0)
Marker Configuration
Radio Frame Start (Delay 0)


Test Case
Instrument
Wanted Signal
Feedback
AWGN
RF Frequency
1.950 000 000
GHz
Duplexing
FDD
Channel Bandwidth
1.4 MHz
Cell ID
150
UE ID / n_RNTI
1



The general and instrument related settings are described in Test Case Settings and Instrument Settings

The settings of the wanted signal are described in chapter 8.6.4, "Wanted Signal and Cell Specific Settings", on page 287.

For description of the propagation conditions settings, the AWGN configuration, and the realtime feedback configuration refer to chapter 8.9.2, "Realtime Feedback Configuration, AWGN and Propagation Condition Settings", on page 327.

**Fraction of Max. Throughput**
Selects the fraction of maximum throughput.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:WS:FMThroughput` on page 552

## 8.9.4 Test Case 8.2.2: UL timing adjustment

### Test Purpose

The test shall verify the receiver's ability to achieve throughput measured for the moving UE at given SNR under moving propagation conditions [6].

### Required Options

- See chapter 8.2, "Basic Configuration", on page 273.
- Option Baseband Main Module (R&S SMW-B13T)
- Frequency Options (R&S SMW-B20x)
- Second Option Digital Standard EUTRA/LTE (R&S SMW-K55)
- 2 Options Additive White Gaussian Noise AWGN (R&S SMW-K62)

- Options Fading Simulator, Fading Simulator Extension and MIMO (R&S SMW-B14/-K71/-K74)
- Option LTE closed loop BS Test (R&S SMW-K69)

### Test Setup

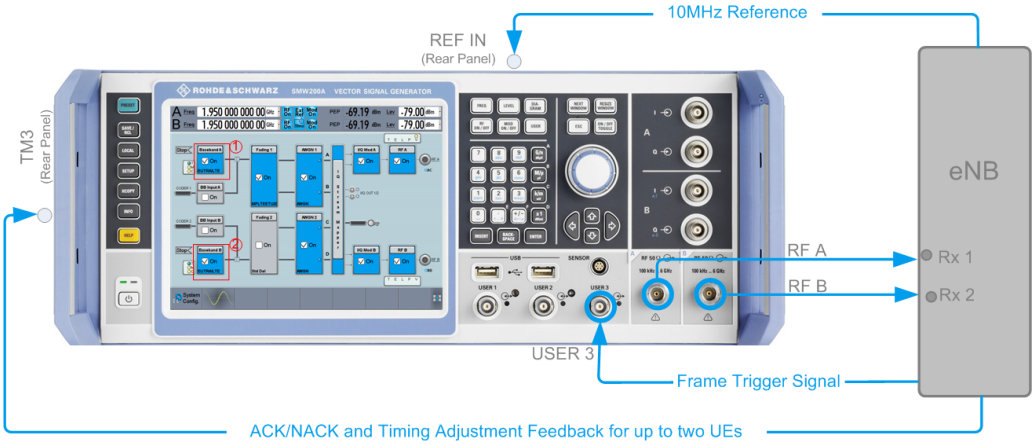



*Fig. 8-12: Test Setup for test case 8.2.2 "UL Timing Adjustment"*

1 = Baseband A generates the signal of the moving UE
2 = Baseband B generates the signal of the stationary UE

### Short Description

For the UL timing adjustment test, the signal generator generated the signal of two user equipments (UEs); path A generates the signal of a moving UE and path B the signal of the stationary one. The throughput is measured by the base station under test.

The performance requirement of PUSCH is expressed as 70% of maximum throughput for the FRC measured for the moving UE at given SNR (see table 8-23). HARQ re-transmissions is assumed. The transmission of the sounding reference signal SRS is optional (see "Transmit SRS" on page 337).

Two moving propagation scenarios are defined; test with scenario 2 are optional. For detailed description of the moving propagation conditions, refer to the descriptionn Operating Manual "Fading Simulator"

The characteristics of the wanted signal (transmitted by moving UE) are adjusted according to the pre-defined FRC and the test parameter given in table 8-22.

*Table 8-22: Test parameters for testing UL timing adjustment*

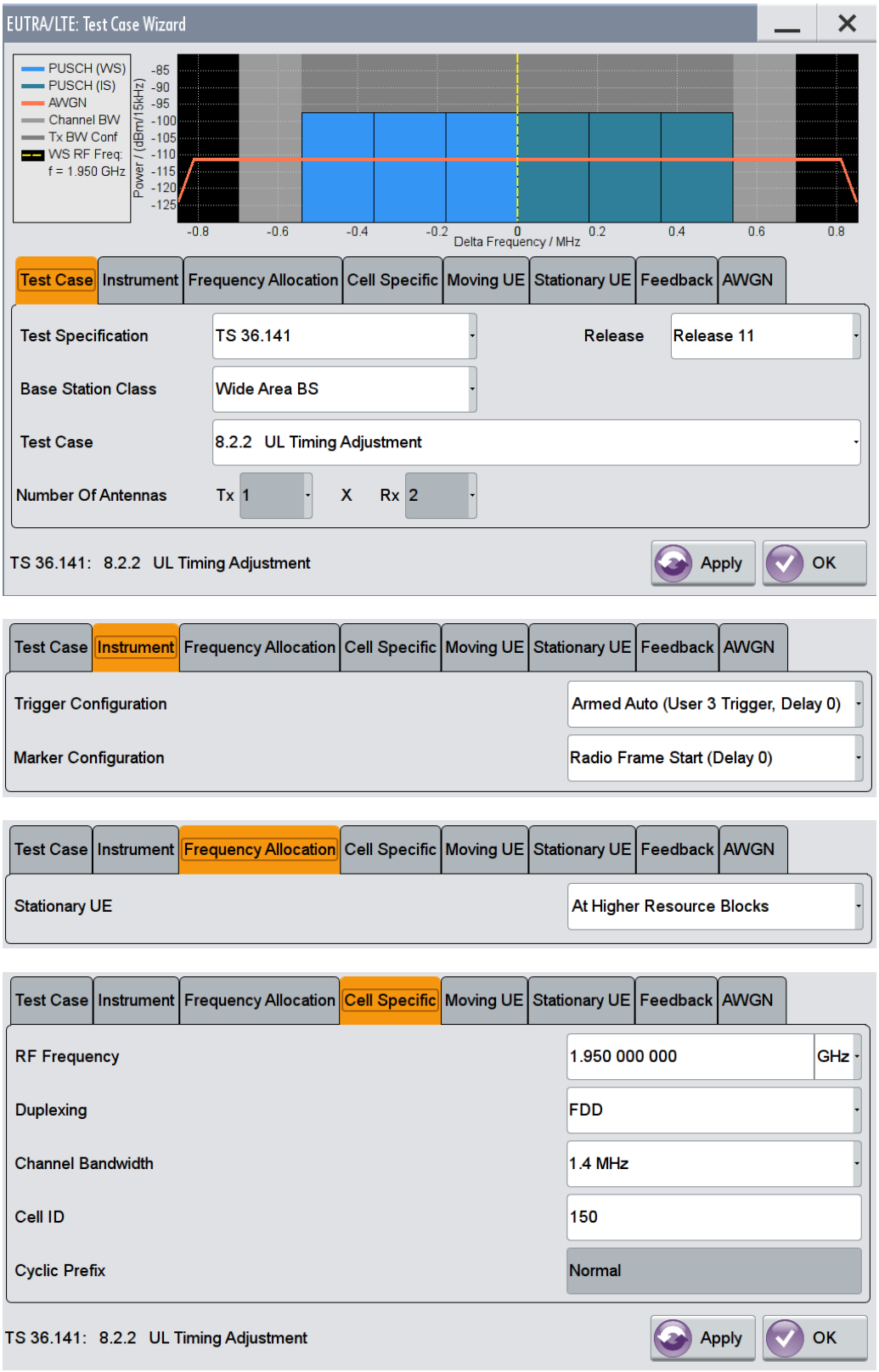
| Parameter | Value |
|---|---|
| Maximum number of HARQ transmissions | 4 |
| RV sequence | 0, 2, 3, 1, 0, 2, 3, 1 |
| Uplink-downlink allocation for TDD | Configuration 1 (2:2) |

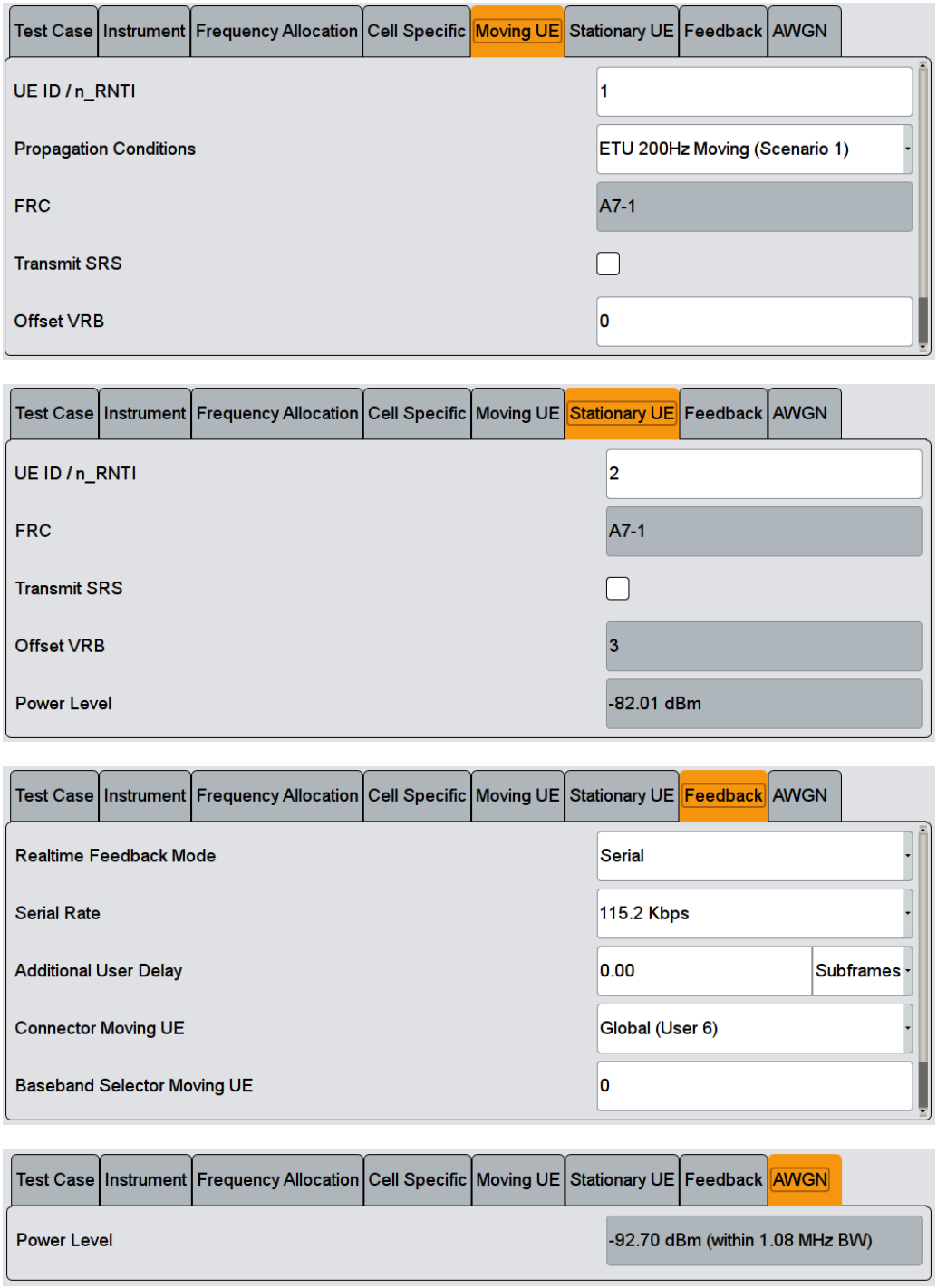
| Parameter | Value |
|---|---|
| Subframes in which PUSCH is transmitted | • For FDD:<br>subframe #0, #2, #4, #6, and #8 in radio frames<br>• For TDD:<br>Subframe #2, #3, #7, #8 in each radio frame |
| Subframes in which SRS is transmitted<br>(SRS transmission is optional) | • For FDD:<br>subframe #1 in radio frames<br>• For TDD:<br>UpPTS in each radio frame |

The table 8-23 shows the test requirements. The test is performed with two Rx antennas and a normal cyclic prefix.

***Table 8-23: Test requirements for UL timing adjustment (two Rx antennas and normal cyclic prefix)***

| Channel Bandwidth, MHz | Moving propagation conditions | FRC | SNR, dB |
|---|---|---|---|
| 1.4 | Scenario 1<br>Scenario 2 | A7-1<br>A8-1 | 13.7<br>-1.6 |
| 3 | Scenario 1<br>Scenario 2 | A7-2<br>A8-2 | 14.0<br>-1.2 |
| 5 | Scenario 1<br>Scenario 2 | A7-3<br>A8-3 | 13.8<br>-1.3 |
| 10 | Scenario 1<br>Scenario 2 | A7-4<br>A8-4 | 14.4<br>-1.5 |
| 15 | Scenario 1<br>Scenario 2 | A7-5<br>A8-5 | 14.6<br>-1.5 |
| 20 | Scenario 1<br>Scenario 2 | A7-6<br>A8-6 | 14.5<br>-1.5 |


EUTRA/LTE: Test Case Wizard
PUSCH (WS)
PUSCH (IS)
AWGN
Channel BW
Tx BW Conf
WS RF Freq:
f = 1.950 GHz
Power / (dBm/15kHz)
-85
-90
-95
-100
-105
-110
-115
-120
-125
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
Delta Frequency / MHz
Test Case
Instrument
Frequency Allocation
Cell Specific
Moving UE
Stationary UE
Feedback
AWGN
Test Specification
TS 36.141
Release
Release 11
Base Station Class
Wide Area BS
Test Case
8.2.2 UL Timing Adjustment
Number Of Antennas
Tx 1
X
Rx 2
TS 36.141: 8.2.2 UL Timing Adjustment
Apply
OK
Test Case
Instrument
Frequency Allocation
Cell Specific
Moving UE
Stationary UE
Feedback
AWGN
Trigger Configuration
Armed Auto (User 3 Trigger, Delay 0)
Marker Configuration
Radio Frame Start (Delay 0)
Test Case
Instrument
Frequency Allocation
Cell Specific
Moving UE
Stationary UE
Feedback
AWGN
Stationary UE
At Higher Resource Blocks
Test Case
Instrument
Frequency Allocation
Cell Specific
Moving UE
Stationary UE
Feedback
AWGN
RF Frequency
1.950 000 000
GHz
Duplexing
FDD
Channel Bandwidth
1.4 MHz
Cell ID
150
Cyclic Prefix
Normal
TS 36.141: 8.2.2 UL Timing Adjustment
Apply
OK




The general and instrument related settings are described in Test Case Settings and Instrument Settings

The cell specific settings and the settings of the moving UE are described in chapter 8.6.4, "Wanted Signal and Cell Specific Settings", on page 287.

For description of the propagation conditions settings, the AWGN configuration, and the realtime feedback configuration refer to chapter 8.9.2, "Realtime Feedback Configuration, AWGN and Propagation Condition Settings", on page 327.

**UE ID/n_RNTI**
Sets the UE ID/n_RNTI.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:MUE:UEID` on page 556
`[:SOURce<hw>]:BB:EUTRa:TCW:SUE:UEID` on page 556

**Transmit SRS**
Enables/disables the transmission of the SRS.

The SRS transmission is optional for this test case.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:MUE:TSRS` on page 548
`[:SOURce<hw>]:BB:EUTRa:TCW:SUE:TSRS` on page 548

**Offset VRB**
Displays the number of RB the allocated RB(s) are shifted with.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:MUE:OVRB` on page 554
`[:SOURce<hw>]:BB:EUTRa:TCW:SUE:OVRB` on page 554

**Connector Moving UE/Stationary UE**
Determines the feedback line connector.

"Global (User 6)" (will be supported in future firmware release)
The following settings apply:
- "EUTRA/LTE > User Equipment > Realtime Feedback > Connector > Global"
- "Global Connector Settings > User 6 > Direction > Input" and "User 6 > Signal > Feedback"

"Local (TM3)" The following settings apply:
- "EUTRA/LTE > User Equipment > Realtime Feedback > Connector > Local"
- "Local Connector Settings > T/M 3 > Direction > Input" and "T/M 3 > Signal > Feedback"

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:RTF:CONMue` on page 549
`[:SOURce<hw>]:BB:EUTRa:TCW:RTF:CONSue` on page 549

**Baseband Selector Moving UE**
("Serial" and "Serial 3x8" mode only)

This parameter is required for multiplexing serial commands for different baseband units to one feedback line. If the selector n is configured in the GUI for a specific baseband unit, the baseband unit will listen only to serial commands containing the selector n.

Remote command:

`[:SOURce<hw>]:BB:EUTRa:TCW:RTF:BBSMue` on page 549

`[:SOURce<hw>]:BB:EUTRa:TCW:RTF:BBSSue` on page 549

### 8.9.5 Test Case 8.2.3: HARQ-ACK multiplexed on PUSCH

#### Test Purpose

The test shall verify the receiver's ability to detect HARQ-ACK information multiplexed on PUSCH under multipath fading propagation conditions for a given SNR [6].

#### Required Options

- See chapter 8.2, "Basic Configuration", on page 273.
- Option Baseband Main Module (R&S SMW-B13T)
- Frequency Options (R&S SMW-B20x)
- 2 Options Additive White Gaussian Noise AWGN R&S SMW-K62)
- 2 Options Fading Simulator (R&S SMW-B14)

#### Test Setup

See chapter 8.4.3, "Test Setup - Diversity Measurements", on page 277 (HARQ feedback line is not required).

#### Short Description

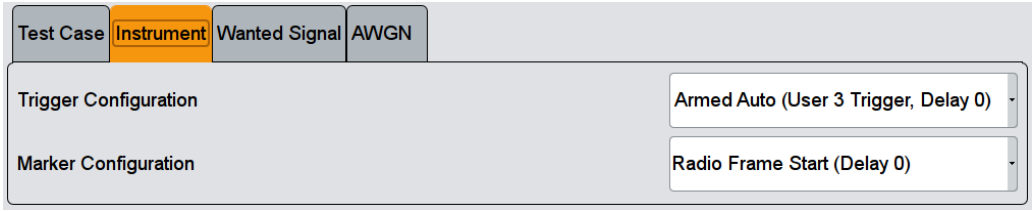
The performance requirement of HARQ-ACK multiplexed on PUSCH is determined by the two parameters: probability of false detection of the ACK and the probability of detection of ACK. The performance is measured by the required SNR at probability of detection equal to 0.99. The probability of false detection of the ACK shall be 0.01 or less.

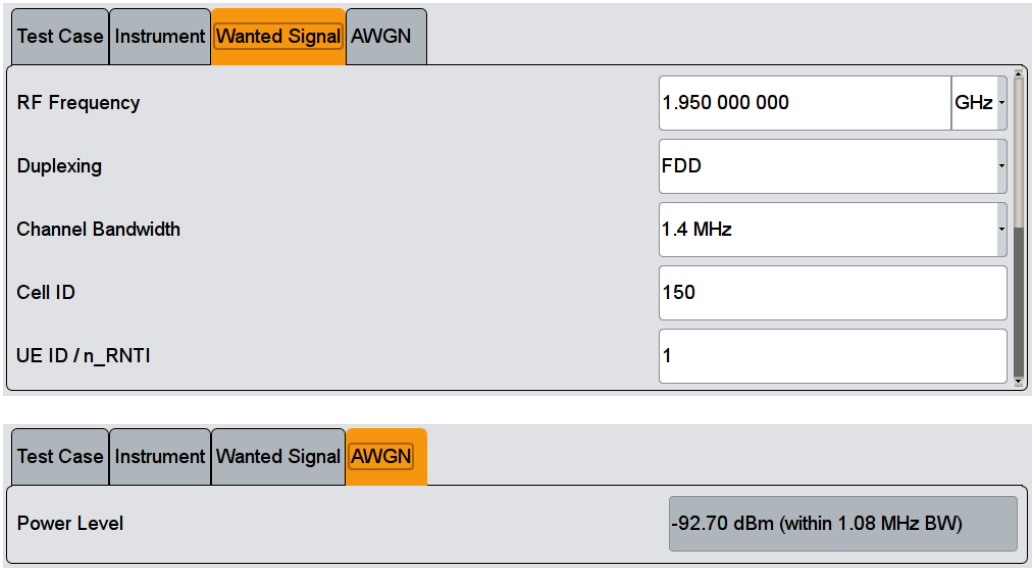
The table 8-24 shows the test requirements. The test are performed with two Rx antennas, normal cyclic prefix and propagation condition ETU70.

***Table 8-24: Test requirements for HARQ-ACK multiplexed on PUSCH (two Rx antennas, normal cyclic prefix and propagation condition ETU70)***

| Channel Bandwidth, MHz | FRC | Index HARQ Offset | SNR, dB |
|---|---|---|---|
| 1.4 | A3-1<br>A4-3 | 8<br>5 | 7.2<br>14.4 |
| 3 | A3-1<br>A4-4 | 8<br>5 | 7.2<br>13.5 |
| 5 | A3-1<br>A4-5 | 8<br>5 | 7.1<br>13.1 |

| Channel Bandwidth, MHz | FRC | Index HARQ Offset | SNR, dB |
|---|---|---|---|
| 10 | A3-1<br>A4-6 | 8<br>5 | 7.2<br>12.9 |
| 15 | A3-1<br>A4-7 | 8<br>5 | 7.3<br>12.7 |
| 20 | A3-1<br>A4-8 | 8<br>5 | 7.1<br>12.6 |






The general and instrument related settings are described in Test Case Settings and Instrument Settings

The settings of the wanted signal are described in chapter 8.6.4, "Wanted Signal and Cell Specific Settings", on page 287.

For description of the propagation conditions settings and the AWGN configuration, refer to "Propagation Conditions" on page 329 and "AWGN Configuration" on page 329.

## 8.9.6 Test Case 8.2.4: High Speed Train conditions

### Test Purpose

The test shall verify the receiver's ability to achieve throughput under High Speed Train conditions for a given SNR [6].

### Required Options

The following options are sufficient for tests with one Rx Antenna:

- See chapter 8.2, "Basic Configuration", on page 273.
- Option Additive White Gaussian Noise AWGN (R&S SMW-K62)
- Option Fading Simulator and Fading Simulator Extension (R&S SMW-B14/-K71)
- Option LTE closed loop BS Test (R&S SMW-K69)

For tests with more than one Rx Antenna, the following options are required additionally:

- Second Option Additive White Gaussian Noise AWGN (R&S SMW-K62)
- Option Baseband Main Module (R&S SMW-B13T)
- Option Fading Simulator (R&S SMW-B14)

### Test Setup

See chapter 8.4.3, "Test Setup - Diversity Measurements", on page 277 and chapter 8.4.1, "Standard Test Setup - One Path", on page 275 (additionally, a feedback line is required).

### Short Description

The performance requirement is determined by a minimum throughput for a given SNR. The requirement throughput is expressed as 30% and 70% of the maximum throughput for the FRC (see table 8-25). HARQ retransmission is assumed. The tests are performed with one or two Rx antennas, normal cyclic prefix and propagation condition HST.

The test is optional.

The characteristics of the wanted signal are adjusted according to the pre-defined FRC and the test parameter given in table 8-26.

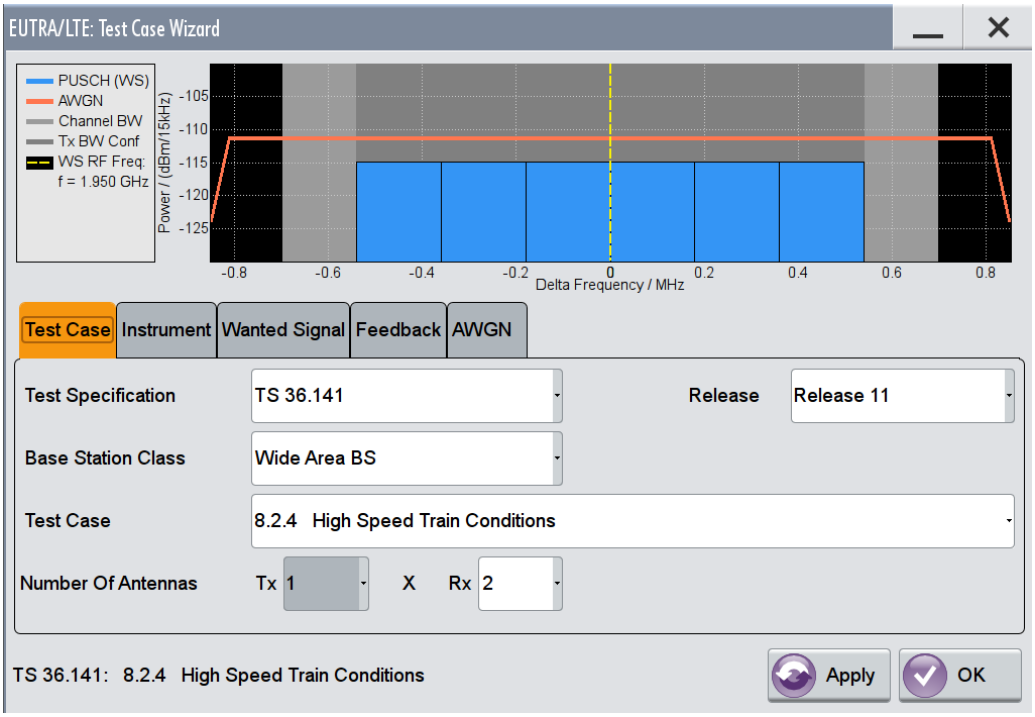
***Table 8-25: Test parameters for High Speed Train conditions***

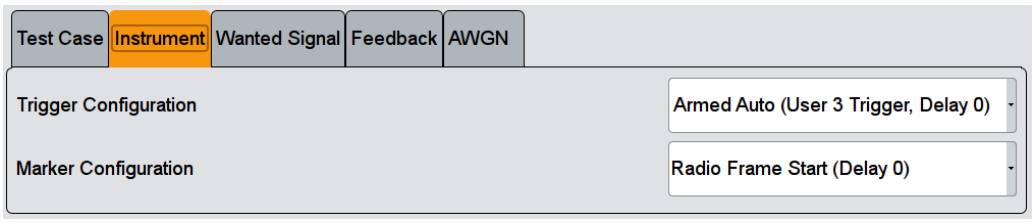
| Parameter | Value |
|---|---|
| Maximum number of HARQ transmissions | 4 |
| RV sequence | 0, 2, 3, 1, 0, 2, 3, 1 |
| Uplink-downlink allocation for TDD | Configuration 1 (2:2) |
| Subframes in which PUSCH is transmitted | For FDD:<br>• subframe #0 and #8 in radio frames for which SFN mod 4 = 0<br>• subframe #6 in radio frames for which SFN mod 4 = 1<br>• subframe #4 in radio frames for which SFN mod 4 = 2<br>• subframe #2 in radio frames for which SFN mod 4 = 3<br>For TDD:<br>• Subframe #2 in each radio frames |
| Subframes in which PUCCH is transmitted * | For FDD:<br>• subframe #5 in radio frames<br>For TDD:<br>• Subframe #3 in each radio frame |
| *) The configuration of PUCCH (format 2) is optional; The SNR values per antenna shall be set to [-4.5 dB and -1.5 dB] for Scenario 1 and 3, respectively. | |

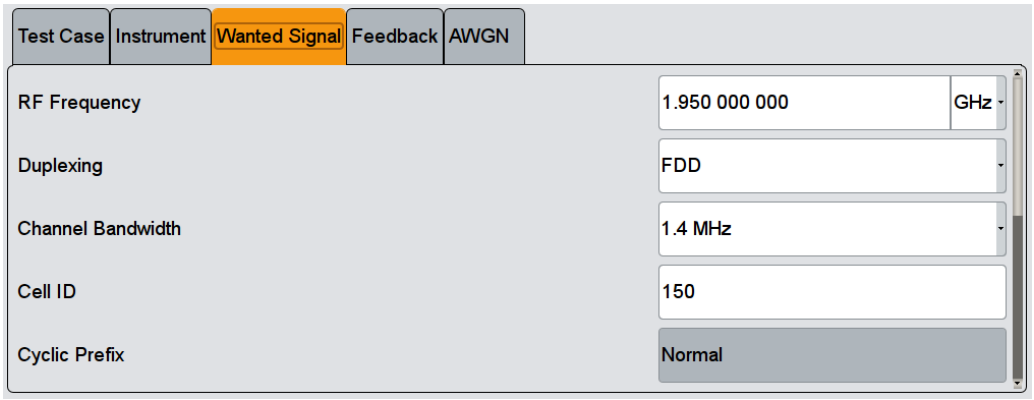
***Table 8-26: Test requirements for High Speed Train conditions***

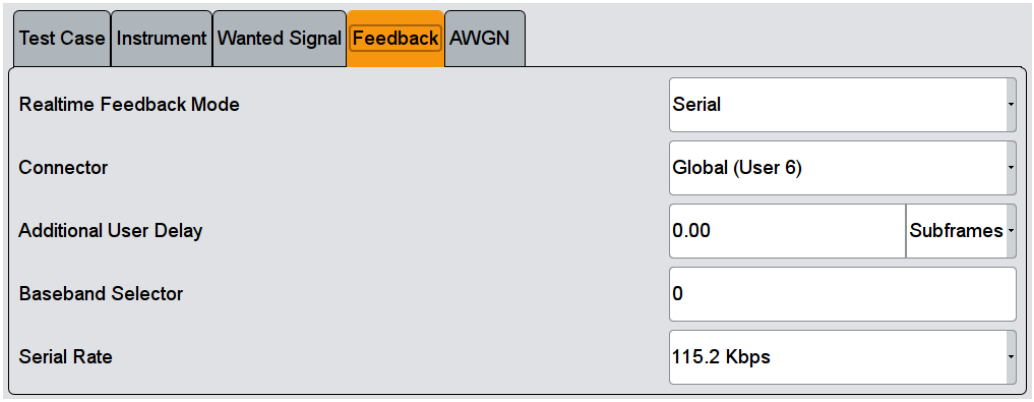
| Channel Bandwidth, MHz | FRC | Number of RX antennas | Propagation conditions | Fraction of maximum throughput, % | SNR, dB |
|---|---|---|---|---|---|
| 1.4 | A3-2 | 1 | HST Scenario 3 | 30<br>70 | -1.2<br>2.2 |
| | | 2 | HST Scenario 1 | 30<br>70 | -3.6<br>-0.3 |

| Channel Band-width, MHz | FRC | Number of RX antennas | Propagation conditions | Fraction of maximum throughput, % | SNR, dB |
|---|---|---|---|---|---|
| 3 | A3-3 | 1 | HST Scenario 3 | 30<br>70 | -1.8<br>1.9 |
| | | 2 | HST Scenario 1 | 30<br>70 | -4.2<br>-0.7 |
| 5 | A3-4 | 1 | HST Scenario 3 | 30<br>70 | -2.3<br>1.6 |
| | | 2 | HST Scenario 1 | 30<br>70 | -4.8<br>-1.1 |
| 10 | A3-5 | 1 | HST Scenario 3 | 30<br>70 | -2.4<br>1.5 |
| | | 2 | HST Scenario 1 | 30<br>70 | -5.1<br>-1.2 |
| 15 | A3-6 | 1 | HST Scenario 3 | 30<br>70 | -2.4<br>1.5 |
| | | 2 | HST Scenario 1 | 30<br>70 | -4.9<br>-1.1 |
| 20 | A3-7 | 1 | HST Scenario 3 | 30<br>70 | -2.4<br>1.5 |
| | | 2 | HST Scenario 1 | 30<br>70 | -5.0<br>-1.1 |


EUTRA/LTE: Test Case Wizard
PUSCH (WS)
AWGN
Channel BW
Tx BW Conf
WS RF Freq:
f = 1.950 GHz
Power / (dBm/15kHz)
-105
-110
-115
-120
-125
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
Delta Frequency / MHz
Test Case
Instrument
Wanted Signal
Feedback
AWGN
Test Specification
TS 36.141
Release
Release 11
Base Station Class
Wide Area BS
Test Case
8.2.4 High Speed Train Conditions
Number Of Antennas
Tx 1
X
Rx 2
TS 36.141: 8.2.4 High Speed Train Conditions
Apply
OK


Test Case
Instrument
Wanted Signal
Feedback
AWGN
Trigger Configuration
Armed Auto (User 3 Trigger, Delay 0)
Marker Configuration
Radio Frame Start (Delay 0)


Test Case
Instrument
Wanted Signal
Feedback
AWGN
RF Frequency
1.950 000 000
GHz
Duplexing
FDD
Channel Bandwidth
1.4 MHz
Cell ID
150
Cyclic Prefix
Normal



The general and instrument related settings are described in Test Case Settings and Instrument Settings

The settings of the wanted signal are described in chapter 8.6.4, "Wanted Signal and Cell Specific Settings", on page 287.

For description of the propagation conditions settings, the AWGN configuration, and the realtime feedback configuration refer to chapter 8.9.2, "Realtime Feedback Configuration, AWGN and Propagation Condition Settings", on page 327.

**Additionally Configure PUCCH**
Enables the optional transmission of PUCCH format 2.

The settings are configured according to table 8-26; the PUCCH Power Level is calculated automatically.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:WS:ACPucch` on page 551

**Power Level (PUSCH)**
Displays the resulting PUSCH power level.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:WS:PLPS?` on page 555

**PUCCH Power Level**
(enabled for activated optional transmission of PUCCH format 2)

Displays the resulting PUCCH power level.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:WS:PLPC?` on page 554

## 8.9.7 Test Case 8.3.1: ACK missed detection for single user PUCCH format 1a

### Test Purpose

The test shall verify the receiver's ability to detect ACK under multipath fading propagation conditions for a given SNR [6].

### Required Options

- See chapter 8.2, "Basic Configuration", on page 273.
- Option Baseband Main Module (R&S SMW-B13T)
- Frequency Options (R&S SMW-B20x)
- 2 Options Additive White Gaussian Noise AWGN (R&S SMW-K62)
- 2 or 4 Options Fading Simulator (R&S SMW-B14)

### Test Setup

The test setup with two Rx antennas is performed according to the standard setup, see chapter 8.4.3, "Test Setup - Diversity Measurements", on page 277 (HARQ feedback line is not required).

The test setup with four Rx antennas requires additional instruments, see chapter 8.4.4, "Test Setup - Four Rx Antennas", on page 277 (HARQ feedback line is not required).

### Short Description

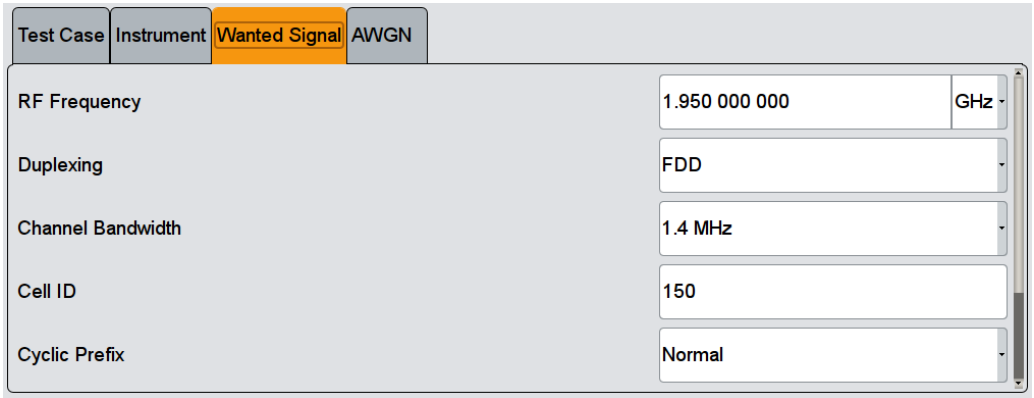
The performance requirement of single user PUCCH for ACK missed detection is determined by the two parameters: probability of false detection of the ACK and the probability of detection of ACK. The performance is measured by the required SNR at probability of detection equal to 0.99. The probability of false detection of the ACK shall be 0.01 or less.

The table 8-27 shows the test requirements for two and four Rx antennas.

***Table 8-27: Required SNR for single user PUCCH format 1a demodulation tests***

| Number of RX antennas | Cyclic Prefix | Propagation Conditions | BW=1.4 MHz | BW=3MHz | BW=5MHz | BW=10MHz | BW=15MHz | BW=20MHz |
|---|---|---|---|---|---|---|---|---|
| 2 | Normal | EPA 5 | -1.9 | -3.3 | -4.2 | -4.8 | -4.7 | -4.5 |
| | | EVA 5 | -3.9 | -4.5 | -4.5 | -4.4 | -4.5 | -4.5 |
| | | EVA 70 | -4.3 | -4.6 | -4.6 | -4.5 | -4.6 | -4.5 |
| | | ETU 300 | -4.4 | -4.5 | -4.3 | -4.4 | -4.6 | -4.6 |
| | Extended | ETU 70 | -3.6 | -3.7 | -3.5 | -3.7 | -3.6 | -3.7 |
| 4 | Normal | EPA 5 | -7.3 | -7.8 | -8.1 | -8.3 | -8.3 | -8.4 |
| | | EVA 5 | -8.2 | -8.5 | -8.5 | -8.2 | -8.3 | -8.3 |
| | | EVA 70 | -8.3 | -8.4 | -8.4 | -8.2 | -8.4 | -8.2 |

| Number of RX antennas | Cyclic Prefix | Propagation Conditions | BW=1.4 MHz | BW=3MHz | BW=5MHz | BW=10MHz | BW=15MHz | BW=20MHz |
|---|---|---|---|---|---|---|---|---|
| | | ETU 300 | -8.1 | -8.3 | -8.1 | -8.1 | -8.3 | -8.2 |
| | Extended | ETU 70 | -7.3 | -7.5 | -7.3 | -7.5 | -7.4 | -7.4 |



The general and instrument related settings are described in Test Case Settings and Instrument Settings

The settings of the wanted signal are described in chapter 8.6.4, "Wanted Signal and Cell Specific Settings", on page 287.

For description of the propagation conditions settings and the AWGN configuration, refer to "Propagation Conditions" on page 329 and "AWGN Configuration" on page 329.

### 8.9.8 Test Case 8.3.2: CQI performance requirements for PUCCH format 2

**Renamed Test Case**

In 3GPP TS 36.141 versions prior to version 8.9.0 this test case was called "CQI missed detection for PUCCH format 2".

#### Test Purpose

The test shall verify the receiver's ability to detect CQI under multipath fading propagation conditions for a given SNR [6].

#### Required Options

- See chapter 8.2, "Basic Configuration", on page 273.
- Option Baseband Main Module (R&S SMW-B13T)
- Frequency Options (R&S SMW-B20x)
- 2 Options Additive White Gaussian Noise AWGN (R&S SMW-K62)
- 2 Options Fading Simulator (R&S SMW-B14)

#### Test Setup

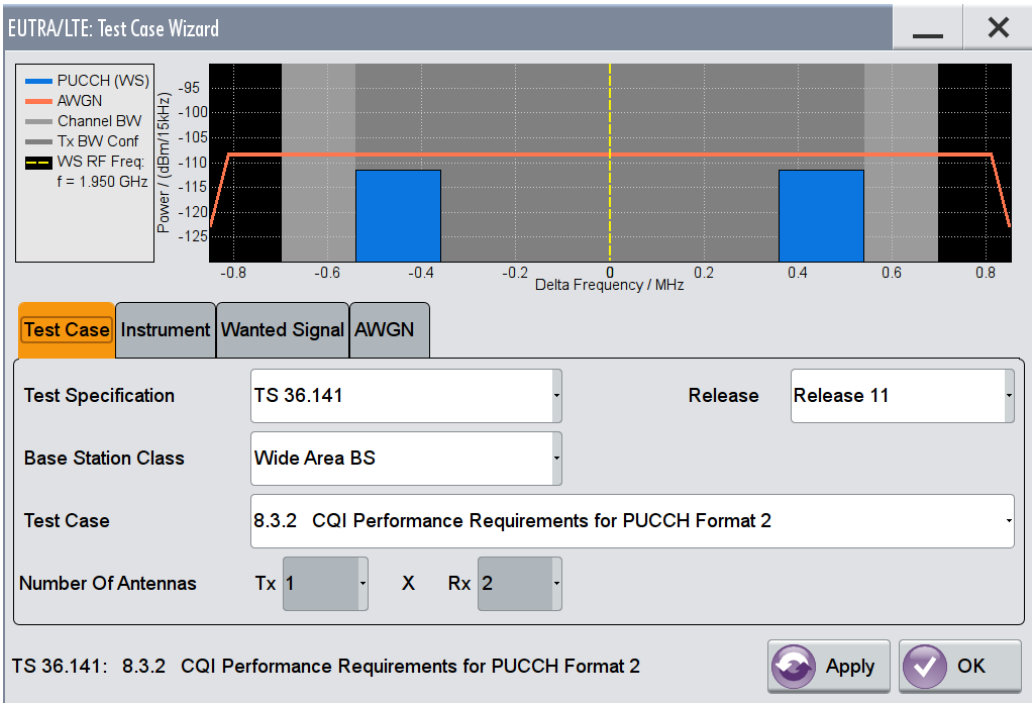
See chapter 8.4.3, "Test Setup - Diversity Measurements", on page 277 (HARQ feedback line is not required).

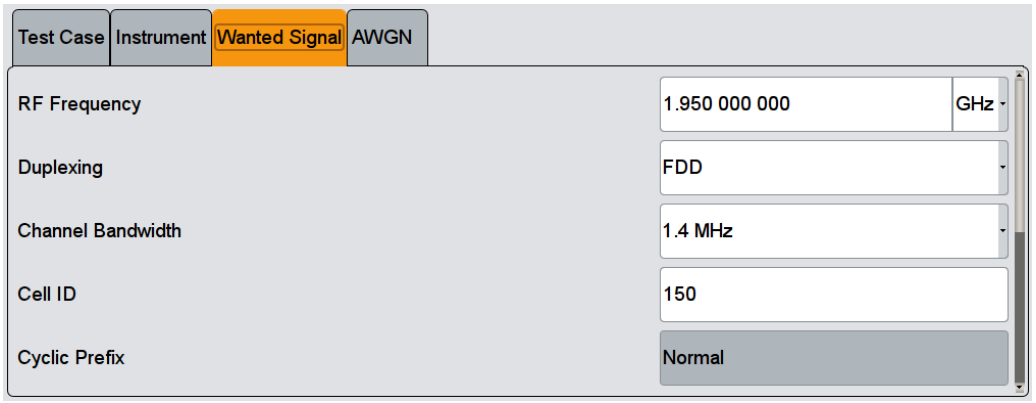
#### Short Description

The performance requirement of PUCCH for CQI is determined by the BLER probability of detection of CQI. The performance is measured by the required SNR at BLER equal to 1%.

*Table 8-28: Required SNR for PUCCH format 2 demodulation tests*

| Number of RX antennas | Cyclic Prefix | Propaga-tion Con-ditions | BW=1.4 MHz | BW=3MHz | BW=5MHz | BW=10MHz | BW=15MHz | BW=20MHz |
|---|---|---|---|---|---|---|---|---|
| 2 | Normal | ETU70 | -3.3 | -3.8 | -3.6 | -3.8 | -3.8 | -3.8 |





The general and instrument related settings are described in Test Case Settings and Instrument Settings

The settings of the wanted signal are described in chapter 8.6.4, "Wanted Signal and Cell Specific Settings", on page 287.

For description of the propagation conditions settings and the AWGN configuration, refer to "Propagation Conditions" on page 329 and "AWGN Configuration" on page 329.

## 8.9.9 Test Case 8.3.3: ACK missed detection for multi user PUCCH format 1a

### Test Purpose

The test shall verify the receiver's ability to detect ACK on the wanted signal at presence of three interfering signals under multipath fading propagation conditions for a given SNR [6].

### Required Options

- See chapter 8.2, "Basic Configuration", on page 273.
- Option Baseband Main Module (R&S SMW-B13T)
- Frequency Options (R&S SMW-B20x)
- 2 Options Additive White Gaussian Noise AWGN (R&S SMW-K62)
- Second Option Digital Standard EUTRA/LTE (R&S SMW-K55)
- 4 Options Fading Simulator (R&S SMW-B14) and option MIMO (R&S SMW-B74)

### Test Setup

The test setup requires a two-path instrument, synchronized via a reference frequency (see figure 8-13). The base station provides its frame trigger signal to the signal generators.

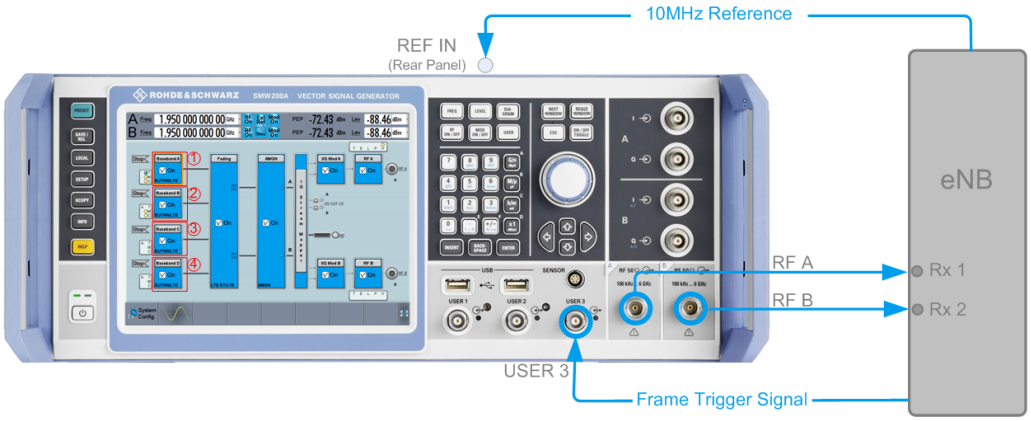



*Fig. 8-13: Test Setup for test case 8.3.3 "ACK missed detection for multi user PUCCH format 1a"*

1 = Baseband A generates the wanted UE signal
2 = Baseband B generates the interferer 1 signal
3 = Baseband C generates the interferer 2 signal
4 = Baseband D generates the interferer 3 signal

### Short Description

The performance is measured on the wanted signal by the required SNR at probability of detection equal to or grater than 0.99. The probability of false detection of the ACK shall be 0.01 or less. The statistics are kept by the base station under test.

Multi user PUCCH test is performed only for 2 Rx antennas, Normal CP and for ETU70 propagation conditions (see table 8-29). ACK/NAK repetitions are disabled for PUCCH transmission.

*Table 8-29: Required SNR for multi user PUCCH demodulation tests*

| Number of RX antennas | Cyclic Prefix | Propagation Conditions | Chan. BW 1.4MHz | Chan. BW 3MHz | Chan. BW 5MHz | Chan. BW 10MHz | Chan. BW 15MHz | Chan. BW 20MHz |
|---|---|---|---|---|---|---|---|---|
| 2 | Normal | ETU70 | -3.5 | -3.8 | -3.8 | -4.0 | -4.0 | -3.8 |

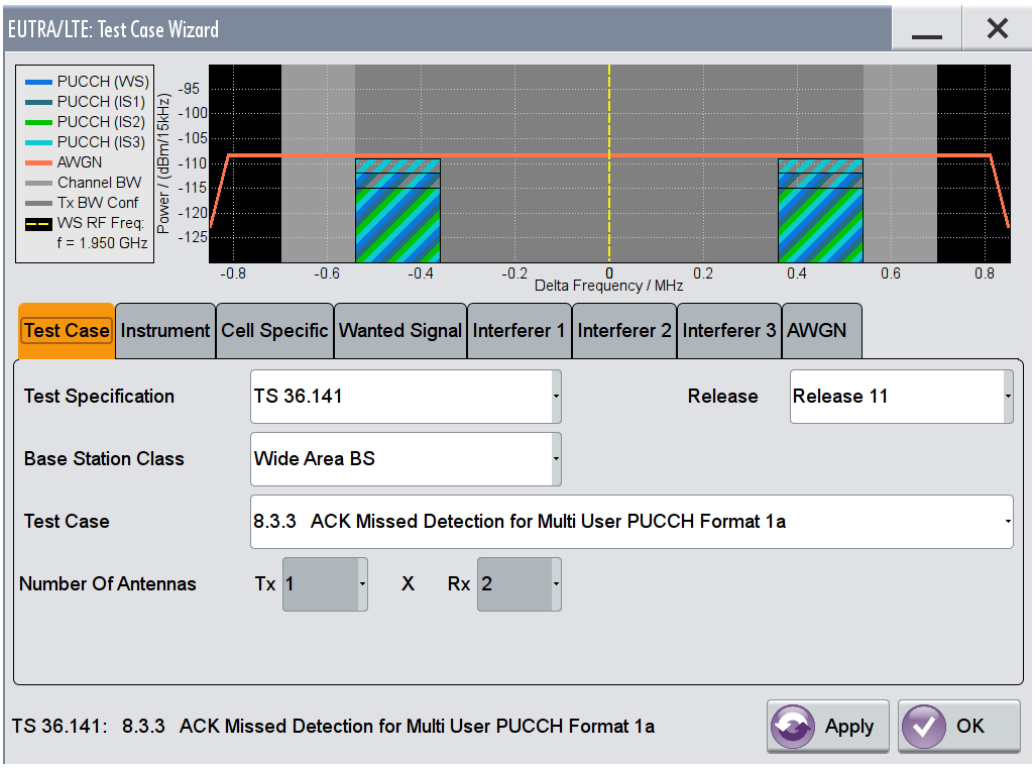
In multi user PUCCH test, four signals are configured: one wanted signal and three interferers, which are transmitted via separate fading paths using relative power settings as defined in table 8-30.

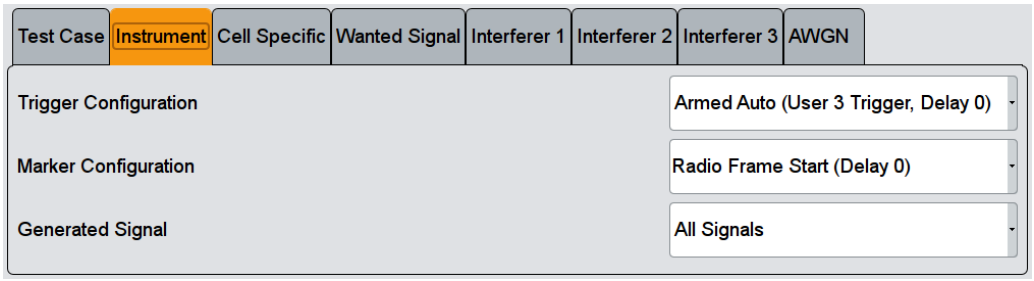
*Table 8-30: Test parameters for multi user PUCCH case*

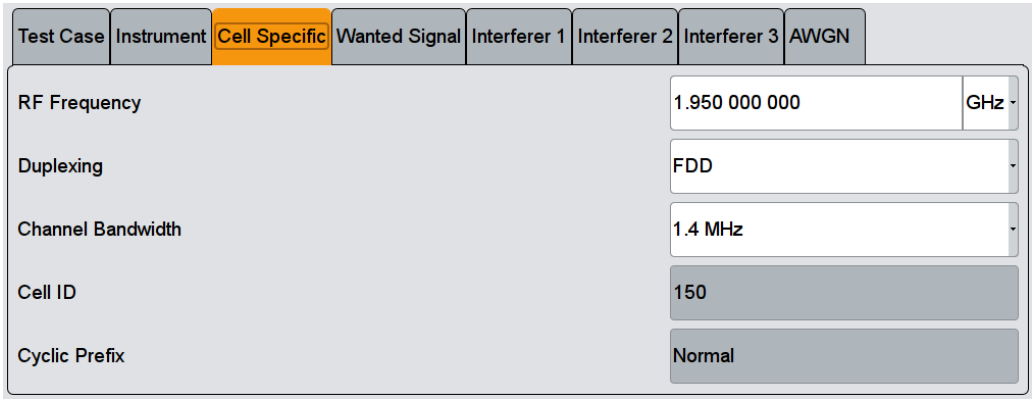
| | Cyclic shift index (δ =0) | Orthogonal cover index | RS orthogonal cover / ACK/NACK orthogonal cover | Relative power, dB | Relative timing, ns |
|---|---|---|---|---|---|
| Tested signal | 4 | 0 | 2 | - | - |
| Interferer 1 | 2 | 0 | 1 | 0 | 0 |
| Interferer 2 | 3 | 1 | 7 | -3 | 0 |
| Interferer 3 | 4 | 2 | 14 | 3 | 0 |

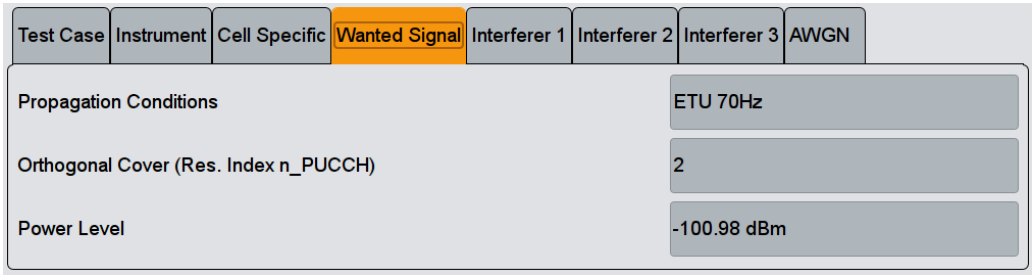
Presented resource index mapping for orthogonal cover and cyclic shift indices are for the first slot of the subframe. All above listed signals are transmitted on the same PUCCH resources, with different PUCCH channel indices as defined in table 8-30.

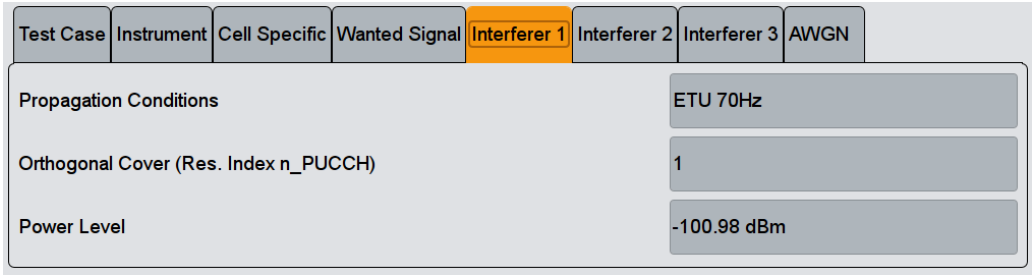
In the multi user PUCCH test, the Test Case Wizard also sets the "Number of Cyclic Shifts" for the mixed format resource block (N_cs^(1)) to 0 and the cyclic shift increment (Delta_shift^PUCCH) to 2, as specified in TS 36.141.

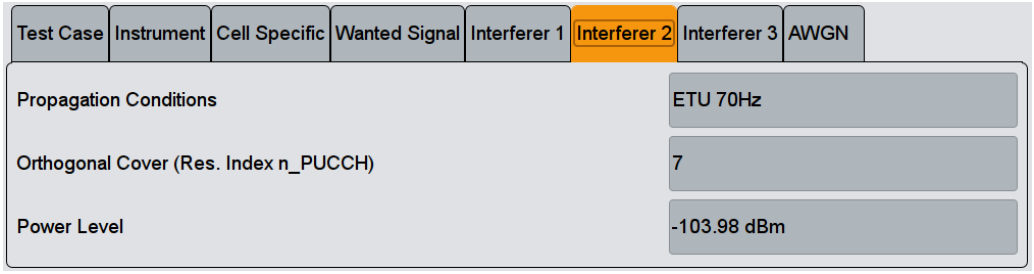


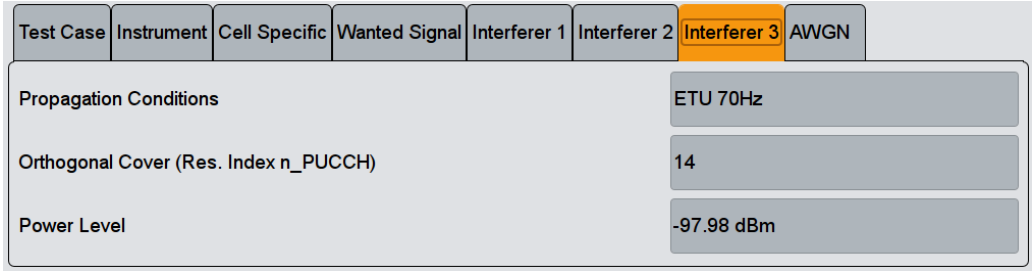



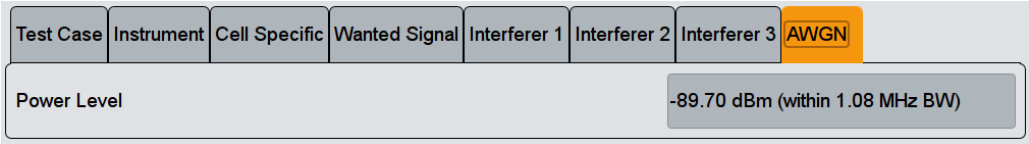

Test Case
Instrument
Cell Specific
Wanted Signal
Interferer 1
Interferer 2
Interferer 3
AWGN
RF Frequency
1.950 000 000
GHz
Duplexing
FDD
Channel Bandwidth
1.4 MHz
Cell ID
150
Cyclic Prefix
Normal


Test Case
Instrument
Cell Specific
Wanted Signal
Interferer 1
Interferer 2
Interferer 3
AWGN
Propagation Conditions
ETU 70Hz
Orthogonal Cover (Res. Index n_PUCCH)
2
Power Level
-100.98 dBm


Test Case
Instrument
Cell Specific
Wanted Signal
Interferer 1
Interferer 2
Interferer 3
AWGN
Propagation Conditions
ETU 70Hz
Orthogonal Cover (Res. Index n_PUCCH)
1
Power Level
-100.98 dBm


Test Case
Instrument
Cell Specific
Wanted Signal
Interferer 1
Interferer 2
Interferer 3
AWGN
Propagation Conditions
ETU 70Hz
Orthogonal Cover (Res. Index n_PUCCH)
7
Power Level
-103.98 dBm


Test Case
Instrument
Cell Specific
Wanted Signal
Interferer 1
Interferer 2
Interferer 3
AWGN
Propagation Conditions
ETU 70Hz
Orthogonal Cover (Res. Index n_PUCCH)
14
Power Level
-97.98 dBm




The general and instrument related settings are described in Test Case Settings and Instrument Settings

The common settings of the wanted signal are described in chapter 8.6.4, "Wanted Signal and Cell Specific Settings", on page 287.

For description of the propagation conditions settings and the AWGN configuration, refer to "Propagation Conditions" on page 329 and "AWGN Configuration" on page 329.

In the R&S SMW, the power level of the interferer 3 is used as a reference, i.e. the power level of the wanted signal and the interferer 1 is 3 dB lower and the power level of the inerferer 2 is 6 dB lower than the reference.

**Generated Signal**
Determines which signals are generated by the instrument. The R&S SMW can generate all required signals out of one box.

In test setup with two instruments, the first R&S SMW should generate the "Wanted Signal, Interfer 1 and AWGN" signal and the second R&S SMW, the signal of "Interferers 2 and 3".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:GS:GENSignals` on page 542

**Propagation Conditions**
Displays the porpagation conditions of the interfering signal.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:IS:PRCOndition?` on page 555
`[:SOURce<hw>]:BB:EUTRa:TCW:IS2:PRCOndition?` on page 555
`[:SOURce<hw>]:BB:EUTRa:TCW:IS3:PRCOndition?` on page 555

**Orthogonal Cover (n_PUCCH)**
Displays the used resource index n_PUCCH. The value is set automaticaly according to the RS orthogonal cover in table 8-30.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:WS:ORTCover?` on page 553
`[:SOURce<hw>]:BB:EUTRa:TCW:IS:ORTCover?` on page 553
`[:SOURce<hw>]:BB:EUTRa:TCW:IS2:ORTCover?` on page 553
`[:SOURce<hw>]:BB:EUTRa:TCW:IS3:ORTCover?` on page 553

**Interferer Type**
Displays the type of the interfering signal.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:IS2:IFTYpe?` on page 546

**RF Frequency**
Displays the center frequency of interfering signal.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:IS2:RFFRequency?` on page 547

**Power Level**
Displays the power level of the interfering signals.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:IS2:PLevel?` on page 547
`[:SOURce<hw>]:BB:EUTRa:TCW:IS3:PLevel?` on page 547

## 8.9.10 Test Case 8.3.4: ACK missed detection for PUCCH format 1b, channel selection

### Test Purpose

The test shall verify the receiver's ability to detect ACK bits under multipath fading propagation conditions for a given SNR [6].

### Required Options

- See chapter 8.2, "Basic Configuration", on page 273.
- Option Baseband Main Module (R&S SMW-B13T)
- Frequency Options (R&S SMW-B20x)
- 2 Options Additive White Gaussian Noise AWGN (R&S SMW-K62)
- Second Option Digital Standard EUTRA/LTE (R&S SMW-K55)
- 2 or 4 Options Fading Simulator (R&S SMW-B14) and option MIMO (R&S SMW-B74)

### Test Setup

The test setup with two Rx antennas is performed according to the standard setup, see chapter 8.4.3, "Test Setup - Diversity Measurements", on page 277 (HARQ feedback line is not required).

The test setup with four Rx antennas requires additional instruments, see chapter 8.4.4, "Test Setup - Four Rx Antennas", on page 277 (HARQ feedback line is not required).

This test case is applicable to all BS.

The R&S SMW generates a signal with 4 encoded ACK/NACK bits per subframe (AAAA).

### Short Description

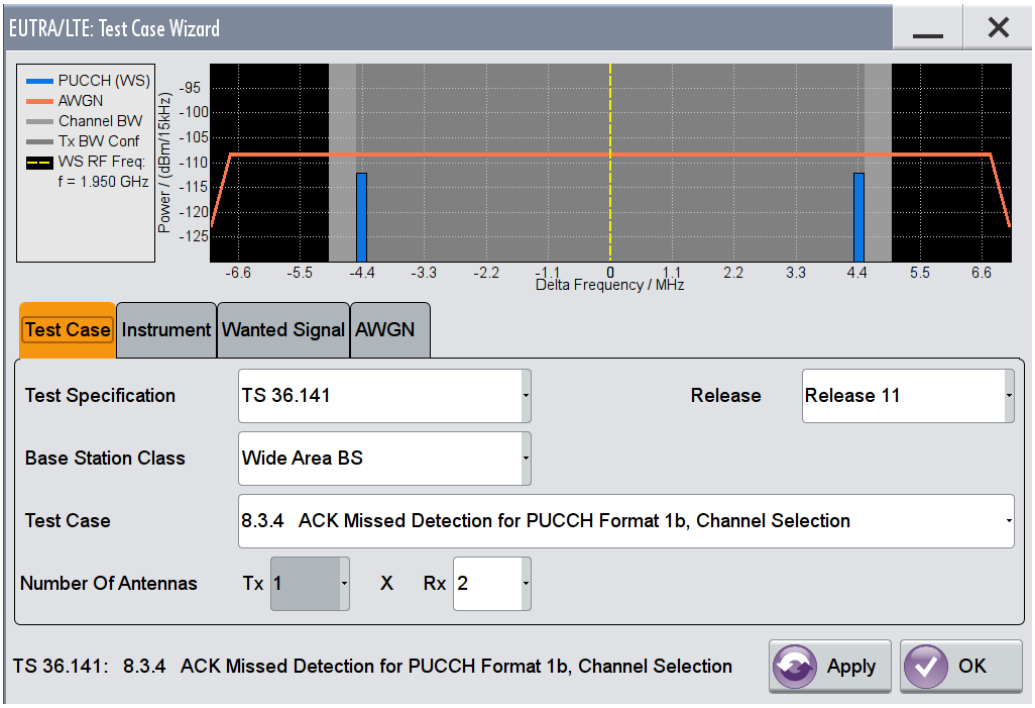
The performance requirement of PUCCH format 1b with Channel Selection for ACK missed detection is determined by:

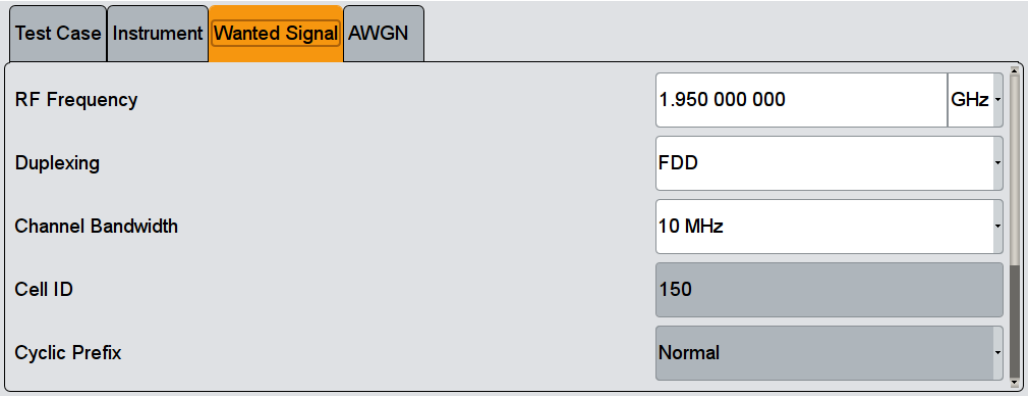
- the probability of false detection of the ACK
- the probability of detection of ACK

The performance is measured on the wanted signal by the required SNR at probability of detection equal to 0.99. The fraction of false detection of the ACK shall be 0.01 or less. The statistics are kept by the base station under test.

***Table 8-31: Required SNR for PUCCH format 1b with channel Selection demodulation tests (Number of Tx antennas = 1)***

| Number of RX antennas | Cyclic Prefix | Propagation Conditions | BW=1.4MHz BW=3MHz BW=5MHz | BW=10MHz | BW=15MHz | BW=20MHz |
|---|---|---|---|---|---|---|
| 2 | Normal | EPA 5 Low | - | -3.9 | -4.0 | -4.0 |
| | Normal | EVA 70 Low | - | -3.7 | -3.9 | -3.9 |
| 4 | Normal | EPA 5 Low | - | -7.8 | -7.9 | -8.0 |
| | Normal | EVA 70 Low | - | -7.7 | -7.9 | -7.9 |





The general and instrument related settings are described in Test Case Settings and Instrument Settings

The common settings of the wanted signal are described in chapter 8.6.4, "Wanted Signal and Cell Specific Settings", on page 287.

For description of the propagation conditions settings and the AWGN configuration, refer to "Propagation Conditions" on page 329 and "AWGN Configuration" on page 329.

## 8.9.11 Test Case 8.3.5: ACK missed detection for PUCCH format 3

### Test Purpose

The test shall verify the receiver's ability to detect ACK bits under codeword's from applicable codebook being randomly selected, multipath fading propagation conditions for a given SNR [6].

### Required Options

- See chapter 8.2, "Basic Configuration", on page 273.
- Option Baseband Main Module (R&S SMW-B13T)
- Frequency Options (R&S SMW-B20x)
- 2 Options Additive White Gaussian Noise AWGN (R&S SMW-K62)
- Second Option Digital Standard EUTRA/LTE (R&S SMW-K55)
- 2 or 4 Options Fading Simulator (R&S SMW-B14) and option MIMO (R&S SMW-B74)

### Test Setup

The test setup with two Rx antennas is performed according to the standard setup, see chapter 8.4.3, "Test Setup - Diversity Measurements", on page 277 (HARQ feedback line is not required).

The test setup with four Rx antennas requires additional instruments, see chapter 8.4.4, "Test Setup - Four Rx Antennas", on page 277 (HARQ feedback line is not required).

This test case is applicable to all BS.

The R&S SMW generates the required signal with 4 or 16 encoded ACK/NACK bits (AN bits) per subframe, as defined with the parameter Number of ACK/NACK bits.

ACK/NACK repetition is disabled for PUCCH transmission. Random codewords selection is assumed.

### Short Description

The performance requirement of PUCCH format 3 for ACK missed detection is determined by:

- the probability of false detection of the ACK
- the probability of detection of ACK

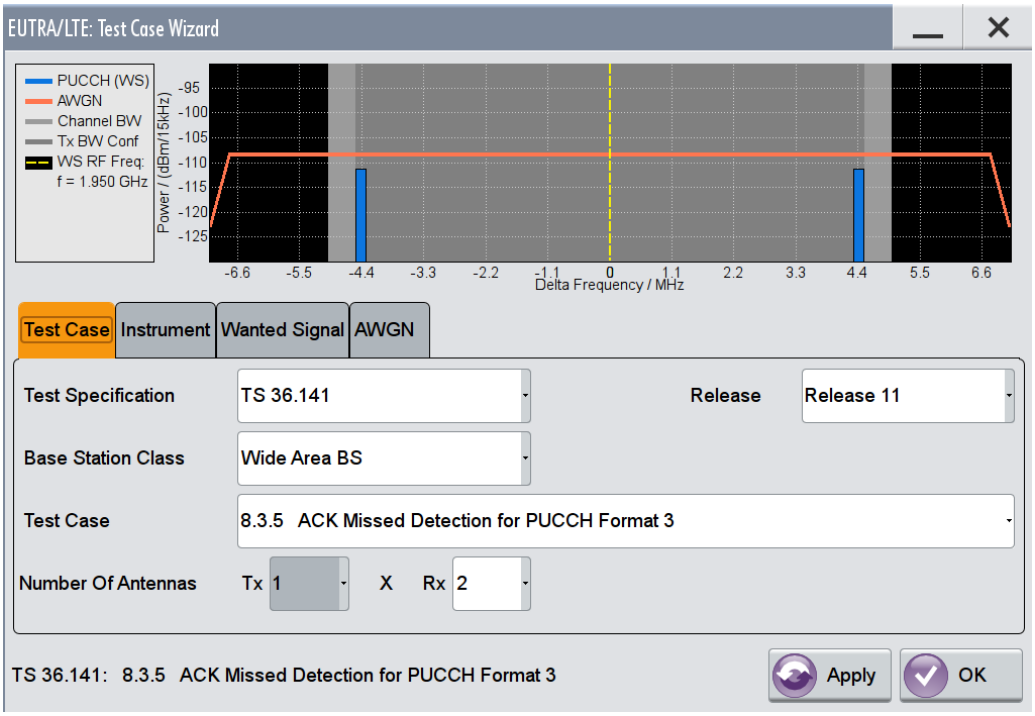
The performance is measured on the wanted signal by the required SNR at probability of detection equal to 0.99. The fraction of false detection of the ACK shall be 0.01 or less. The statistics are kept by the base station under test.

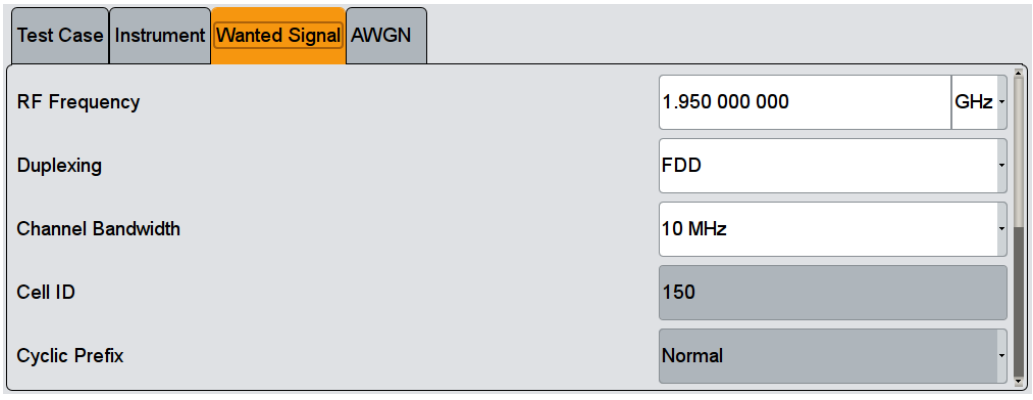
***Table 8-32: Required SNR for PUCCH format 3 demodulation tests, 4AN bits (Number of Tx antennas = 1)***

| Number of RX antennas | Cyclic Prefix | Propagation Conditions | BW=1.4MHz BW=3MHz BW=5MHz | BW=10MHz | BW=15MHz | BW=20MHz |
|---|---|---|---|---|---|---|
| 2 | Normal | EPA 5 Low | - | -3.1 | -3.2 | -3.2 |
| | Normal | EVA 70 Low | - | -2.9 | -3.0 | -3.1 |
| 4 | Normal | EPA 5 Low | - | -6.7 | -6.8 | -6.9 |
| | Normal | EVA 70 Low | - | -6.6 | -6.7 | -6.7 |

***Table 8-33: Required SNR for PUCCH format 3 demodulation tests, 16AN bits (Number of Tx antennas = 1)***

| Number of RX antennas | Cyclic Prefix | Propagation Conditions | BW=1.4MHz BW=3MHz BW=5MHz | BW=10MHz | BW=15MHz | BW=20MHz |
|---|---|---|---|---|---|---|
| 2 | Normal | EPA 5 Low | - | -0.7 | -0.6 | -0.6 |
| | Normal | EVA 70 Low | - | -0.2 | -0.3 | -0.3 |
| 4 | Normal | EPA 5 Low | - | -4.7 | -4.7 | -4.8 |
| | Normal | EVA 70 Low | - | -4.4 | -4.5 | -4.5 |





The general and instrument related settings are described in Test Case Settings and Instrument Settings

The common settings of the wanted signal are described in chapter 8.6.4, "Wanted Signal and Cell Specific Settings", on page 287.

For description of the propagation conditions settings and the AWGN configuration, refer to "Propagation Conditions" on page 329 and "AWGN Configuration" on page 329.

**Number of ACK/NACK bits**
Determines the number of encoded AN bits per subframe.

"4" Applicable for TDD and FDD (see Duplexing)

"16" Applicable for TDD

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:WS:ANBits` on page 551

**ACK/NACK + SR Pattern**
Displays the used ACK/NACK + SR pattern, depending on the selected Number of ACK/NACK bits.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:WS:ANPattern?` on page 551

## 8.9.12 Test Case 8.3.6: NACK to ACK detection for PUCCH format 3

**Test Purpose**

The test shall verify the receiver's ability not to falsely detect NACK bits, transmitted in codeword randomly selected from applicable codebook, as ACK bits under multipath fading propagation conditions for a given SNR [6].

**Required Options**

- See chapter 8.2, "Basic Configuration", on page 273.
- Option Baseband Main Module (R&S SMW-B13T)
- Frequency Options (R&S SMW-B20x)
- 2 Options Additive White Gaussian Noise AWGN (R&S SMW-K62)
- Second Option Digital Standard EUTRA/LTE (R&S SMW-K55)
- 2 or 4 Options Fading Simulator (R&S SMW-B14) and option MIMO (R&S SMW-B74)

**Test Setup**

The test setup with two Rx antennas is performed according to the standard setup, see chapter 8.4.3, "Test Setup - Diversity Measurements", on page 277 (HARQ feedback line is not required).

The test setup with four Rx antennas requires additional instruments, see chapter 8.4.4, "Test Setup - Four Rx Antennas", on page 277 (HARQ feedback line is not required).

This test case is applicable to all BS.

The R&S SMW generates the required signal with 16 encoded ACK/NACK bits (AN bits) per subframe.

ACK/NACK repetition is disabled for PUCCH transmission. Random codewords selection is assumed.

### Short Description

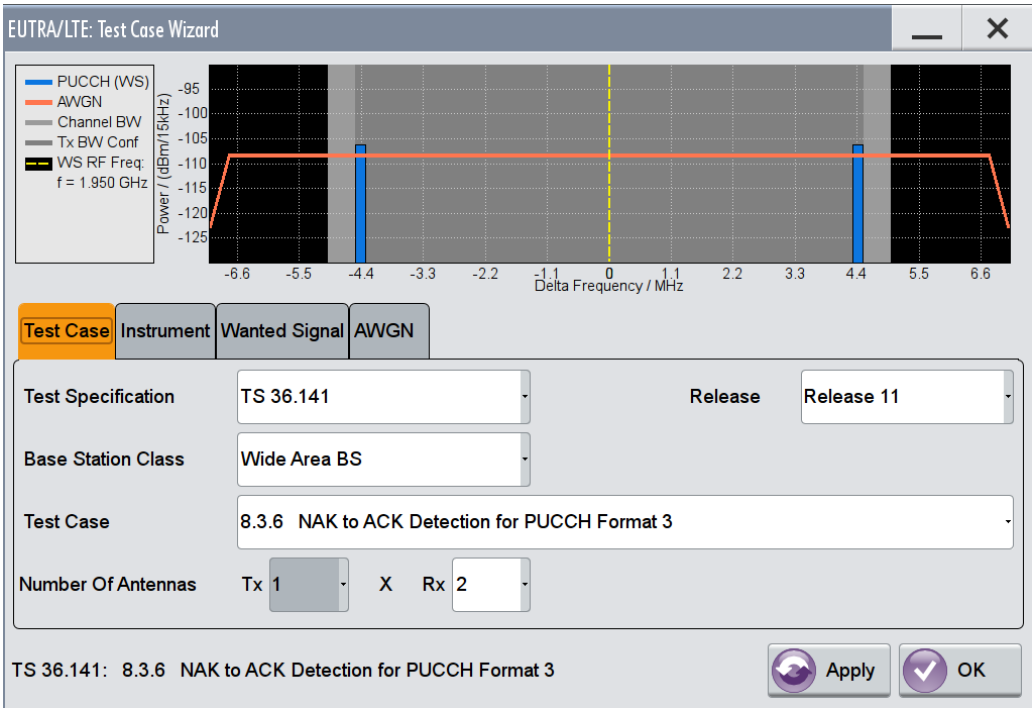
The performance requirement of PUCCH format 3 for NACK to ACK detection is determined by:

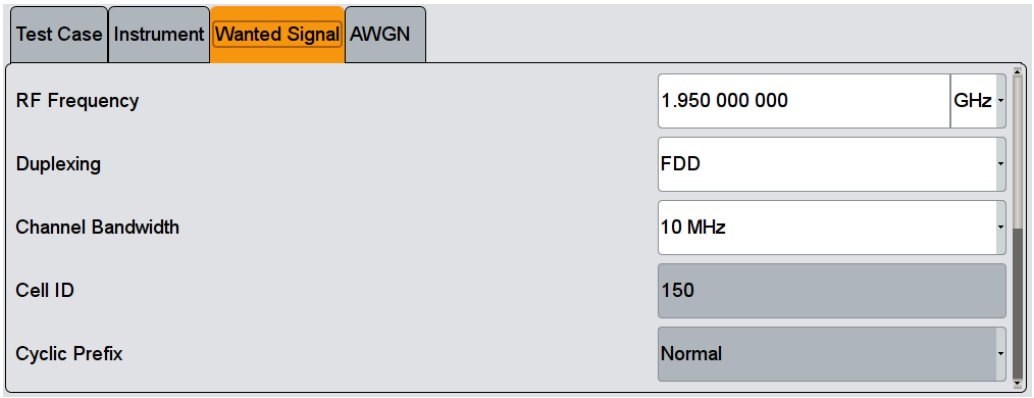
- the probability of false detection of the ACK
- the probability of detection of ACK

The performance is measured on the wanted signal by the required SNR at probability of detection equal to 0.99. The fraction of false detection of the ACK shall be 0.01 or less. The statistics are kept by the base station under test.

***Table 8-34: Required SNR for PUCCH format 3 demodulation tests, 16AN bits (Number of Tx antennas = 1)***

| Number of RX antennas | Cyclic Prefix | Propagation Conditions | BW=1.4MHz BW=3MHz BW=5MHz | BW=10MHz | BW=15MHz | BW=20MHz |
|---|---|---|---|---|---|---|
| 2 | Normal | EPA 5 Low | - | 2.0 | 2.2 | -2.1 |
| | Normal | EVA 70 Low | - | 2.7 | 2.5 | -2.5 |
| 4 | Normal | EPA 5 Low | - | -2.5 | -2.7 | -2.9 |
| | Normal | EVA 70 Low | - | -2.3 | -2.5 | -2.6 |





The general and instrument related settings are described in Test Case Settings and Instrument Settings

The common settings of the wanted signal are described in chapter 8.6.4, "Wanted Signal and Cell Specific Settings", on page 287.

For description of the propagation conditions settings and the AWGN configuration, refer to "Propagation Conditions" on page 329 and "AWGN Configuration" on page 329.

## 8.9.13 Test Case 8.3.9: CQI Performance for PUCCH format 2 with DTX detection

### Test Purpose

The test shall verify the receiver's ability to detect CQI under multipath fading propagation conditions for a given SNR [6].

### Required Options

- See chapter 8.2, "Basic Configuration", on page 273.
- Option Baseband Main Module (R&S SMW-B13T)
- Frequency Options (R&S SMW-B20x)
- 2 Options Additive White Gaussian Noise AWGN (R&S SMW-K62)
- 2 Options Fading Simulator (R&S SMW-B14) and option MIMO (R&S SMW-B74)

- For test setups with 2 Tx antennas, second Option Digital Standard EUTRA/LTE (R&S SMW-K55)

### Test Setup

The test setup is performed according to the standard setup, see chapter 8.4.3, "Test Setup - Diversity Measurements", on page 277 (HARQ feedback line is not required).

This test case is optional and applicable to a BS supporting PUCCH format 2 with DTX.

### Short Description

The performance requirement of PUCCH format 2 for CQI detection is determined by the block error probability (BLER) of CQI.

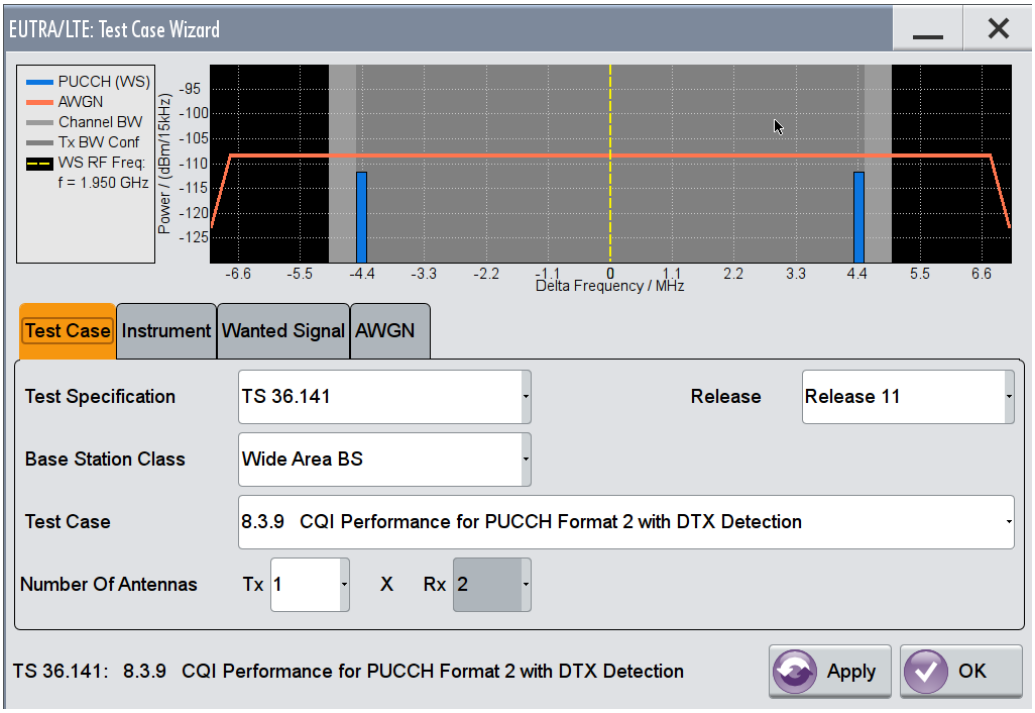
The performance is measured on the wanted signal by the required SNR at BLER of 1%.

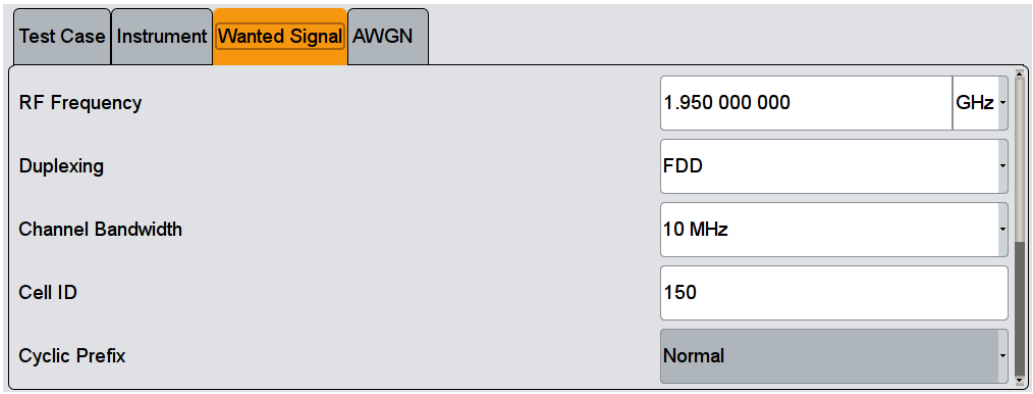
***Table 8-35: Required SNR for PUCCH format 2 demodulation tests with DTX detection (Number of Rx antennas = 2)***

| Number of TX antennas | Cyclic Prefix | Propagation Conditions | BW=1.4 MHz | BW=3MHz | BW=5MHz | BW=10MHz | BW=15MHz | BW=20MHz |
|---|---|---|---|---|---|---|---|---|
| 1 | Normal | EVA 5* Low | -3.1 | -3.4 | -3.8 | -3.4 | -3.6 | -3.6 |
| | | ETU 70** Low | -3.1 | -3.4 | -3.2 | -3.5 | -3.3 | -3.5 |
| 2 | | EVA 5 Low | -4.5 | -4.4 | -4.7 | -4.6 | -4.5 | -4.7 |

*) Not applicable for Wide Area BS and Medium Range BS

**) Not applicable for Local Area BS and Home BS





The general and instrument related settings are described in Test Case Settings and Instrument Settings

The common settings of the wanted signal are described in chapter 8.6.4, "Wanted Signal and Cell Specific Settings", on page 287.

For description of the propagation conditions settings and the AWGN configuration, refer to "Propagation Conditions" on page 329 and "AWGN Configuration" on page 329.

**Orthogonal Cover (Res. Index n_PUCCH) Port 0/1**
Displays the used resource index n_PUCCH for port 0 and port 1 respectively.

The number of ports is determined by the selected Number of Tx Antennas.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:WS:ORTCover[:PORT<ch0>]?` on page 553

**CQI Pattern Port 0/1 (bin)**
Sets the CQI pattern per enabled port.

The number of ports is determined by the selected Number of Tx Antennas.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:WS:CQIPattern:PORT<ch0>` on page 552

## 8.9.14 Test Case 8.4.1: PRACH false alarm probability and missed detection

### Test Purpose

The test shall verify the receiver's ability to detect PRACH preamble under multipath fading propagation conditions for a given SNR [6].

### Required Options

- See chapter 8.2, "Basic Configuration", on page 273.
- Option Baseband Main Module (R&S SMW-B13T)
- Frequency Options (R&S SMW-B20x)
- 2 Options Additive White Gaussian Noise AWGN (R&S SMW-K62)
- 2 Options Fading Simulator (R&S SMW-B14)

### Test Setup

The test setup with two Rx antennas is performed according to the standard setup, see chapter 8.4.3, "Test Setup - Diversity Measurements", on page 277 (HARQ feedback line is not required).

The test setup with four Rx antennas requires additional instruments, see chapter 8.4.4, "Test Setup - Four Rx Antennas", on page 277 (HARQ feedback line is not required).

### Short Description

The performance is measured by the total probability of false detection of the preamble (Pfa) and the probability of detection of preamble (Pd). For the SNRs defined in table 8-36 and table 8-37, the Pd shall be 99% or grater, Pfa shall be 0.1% or less. The statistics are kept by the base station under test. Ten preambles have to be transmitted.

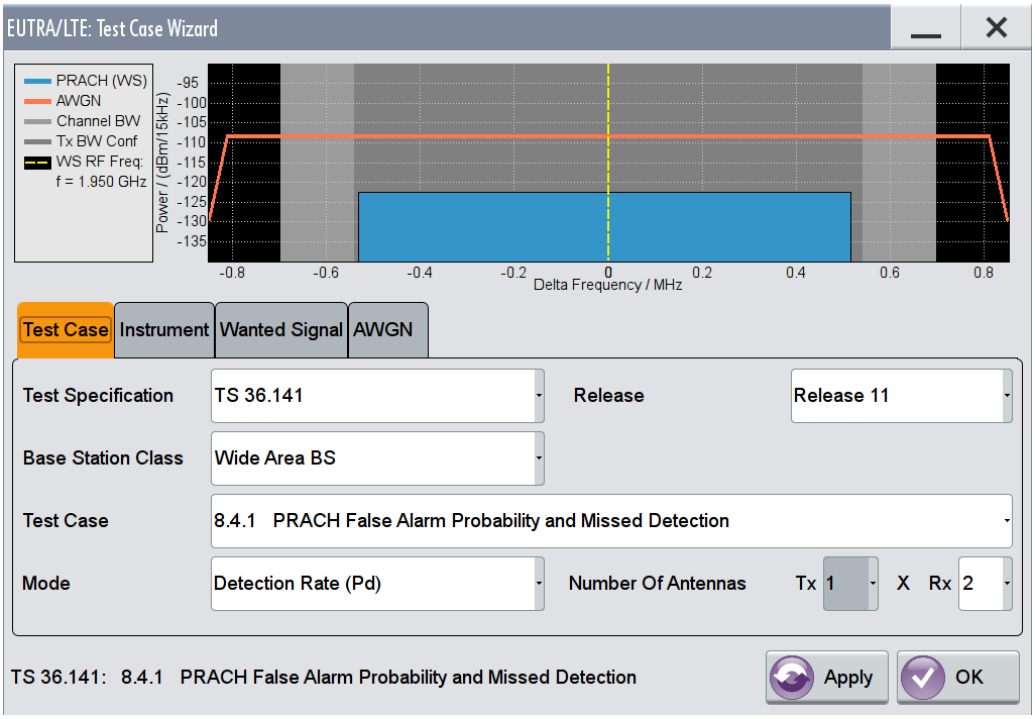
The normal mode test is applicable to all BS. The high speed mode test is applicable to high speed BS.

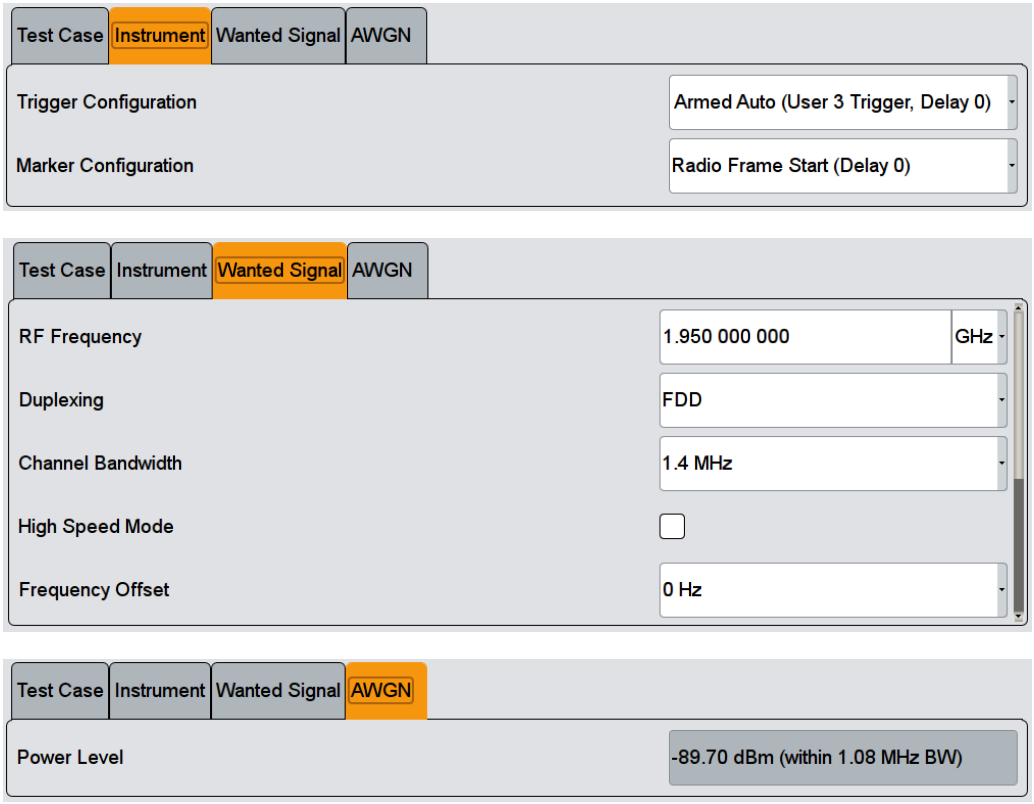
*Table 8-36: PRACH missed detection test requirements for Normal Mode; the SNR [dB] is given per burst format*

| Number of RX antennas | Propagation conditions | Frequency offset, Hz | Burst format 0 | Burst format 1 | Burst format 2 | Burst format 3 | Burst format 4 |
|---|---|---|---|---|---|---|---|
| 2 | AWGN | 0 | -13.9 | -13.9 | -16.1 | -16.2 | -6.9 |
| | ETU 70 | 270 | -7.4 | -7.2 | -9.4 | -9.5 | 0.5 |
| 4 | AWGN | 0 | -16.6 | -16.4 | -18.7 | -18.5 | -9.5 |
| | ETU 70 | 270 | -11.5 | -11.1 | -13.5 | -13.3 | -4.5 |

*Table 8-37: PRACH missed detection test requirements for High speed Mode; the SNR [dB] is given per burst format*

| Number of RX antennas | Propagation conditions | Frequency offset, Hz | Burst format 0 | Burst format 1 | Burst format 2 | Burst format 3 |
|---|---|---|---|---|---|---|
| 2 | AWGN | 0 | -13.8 | -13.9 | -16.0 | -16.3 |
| | ETU 70 | 270 | -6.8 | -6.7 | -8.7 | -8.9 |
| | AWGN | 625 | -12.1 | -12.0 | -14.1 | -14.1 |
| | AWGN | 1340 | -13.1 | -13.2 | -15.2 | -15.4 |
| 4 | AWGN | 0 | -16.6 | -16.3 | -18.6 | -18.5 |
| | ETU 70 | 270 | -11.2 | -10.8 | -13.1 | -13.1 |
| | AWGN | 625 | -14.6 | -14.3 | -16.5 | -16.5 |
| | AWGN | 1340 | -15.6 | -15.2 | -17.5 | -17.5 |






The general and instrument related settings are described in Test Case Settings and Instrument Settings

The common settings of the wanted signal are described in chapter 8.6.4, "Wanted Signal and Cell Specific Settings", on page 287.

For description of the propagation conditions settings and the AWGN configuration, refer to "Propagation Conditions" on page 329 and "AWGN Configuration" on page 329.

For detailed description of all available PRACH settings and the cross-reference between them, refer to chapter 7.16.9, "PRACH Configuration", on page 247.

**Mode**
Determines the measurements type, Pfa or Pd, the signal is generated for.

In "Detection Rate (Pd)" and "Alternating Pd and Pfa" mode, the generated sequence is repeated cyclically. The first preamble is offset with start offset determined by Timing Offset Base Value. From preamble to preamble, the timing offset ("Delta t") of the preambles is increased by 0.1 us.

| | |
|---|---|
| "False Detection Rate (Pfa)" | The generated signal is a noise like AWGN signal. This mode is intended for measurement of the total probability of false detection of the preamble (Pfa). |
| "Detection Rate (Pd)" | The generated signal is a sequence of 10 preamble and noise. The duration of one single sequence is 5 frames in FDD and 10 frames in TDD duplexing mode.<br>This mode is intended for measurement of the probability of detection of preamble (Pd). |

"Alternating Pd and Pfa" The generated signal is a sequence of 10 enabled and 10 disabled preambles; during the latest only noise is transmitted. The duration of one single sequence is 10 FDD frames and 20 TDD frames.
This mode is intended for measuring both the probability of detection of preamble (Pd) and the probability of false detection of the preamble (Pfa) in one run.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:GS:MODE` on page 543

**Configuration of Special Subframe**
(enabled for TDD duplexing mode only)

Sets the Special Subframe Configuration number (see also chapter 3.2.1, "OFDMA Parameterization", on page 18).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:WS:SPSFrame` on page 555

**High Speed Mode**
Enables a high speed mode (restricted preamble set) or the normal mode (unrestricted preamble set).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:WS:HSMode` on page 553

**Frequency Offset**
Sets the frequency offset, as defined in table 8-36 and table 8-37.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:WS:FROffset` on page 553

**Burst Format**
Sets the burst format (see also "Preamble Format (Burst Format)" on page 248).

Burst format 4 is enabled only for TDD duplexing mode, special subframe configurations 5 to 8 and disabled high speed mode.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:WS:BFormat` on page 551

**Timing Offset Base Value**
The timing offset base value is set to 50% of the Ncs. This value determines the start timing offset of the first preamble. From preamble to preamble, the timing offset ("Delta t") of the preambles is increased by 0.1 us and this sequence of timing offsets is restarted after 10 preambles.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:WS:TIOBase?` on page 556

# 9 Remote-Control Commands

The following commands are required to perform signal generation with the EUTRA/LTE options in a remote environment. We assume that the R&S SMW has already been set up for remote operation in a network as described in the R&S SMW documentation. A knowledge about the remote control operation and the SCPI command syntax are assumed.

This subsystem contains commands for the primary and general settings of the EUTRA/LTE standard. These settings concern activation and deactivation of the standard, setting the transmission direction, filter, clock, trigger and clipping settings, defining the frame configuration and the sequence length, as well as the preset setting.

The commands for defining the frame configuration for physical layer mode OFDMA and SC-FDMA are described in the next sections. The commands are divided up in this way to make the comprehensive `SOURce:BB:EUTRa` subsystem clearer.

### Common Suffixes

The following common suffixes are used in remote commands:

| Suffix | Value range | Description |
|---|---|---|
| `SOURce<hw>` | [1] .. 4 | available baseband signals |
| `OUTPut<ch>` | [1] .. 3 | available markers |

Basic tasks that are also performed in the base unit in the same way are not described here.

For a description of such tasks, see the R&S SMW User Manual.

In particular, this includes:

- Managing settings and data lists, i.e. storing and loading settings, creating and accessing data lists, etc.
- Information on regular trigger, marker and clock signals as well as filter settings, if appropriate.
- General instrument configuration, e.g. checking the system configuration, configuring networks and remote operation
- Using the common status registers

The following commands specific to the EUTRa standard are described here:

## 9.1 Primary Commands

[:SOURce<hw>]:BB:EUTRa:STATe ..... 369
[:SOURce<hw>]:BB:EUTRa:DUPLexing ..... 369
[:SOURce<hw>]:BB:EUTRa:LINK ..... 370

[:SOURce<hw>]:BB:EUTRa:PRESet....370
[:SOURce<hw>]:BB:EUTRa:SETTing:CATalog....370
[:SOURce<hw>]:BB:EUTRa:SETTing:DEL....371
[:SOURce<hw>]:BB:EUTRa:SETTing:LOAD....371
[:SOURce<hw>]:BB:EUTRa:SETTing:STORe....371
[:SOURce<hw>]:BB:EUTRa:SETTing:STORe:FAST....371
[:SOURce<hw>]:BB:EUTRa:SETTing:TMOD:TDD....372
[:SOURce<hw>]:BB:EUTRa:SETTing:TMOD:DL....372
[:SOURce<hw>]:BB:EUTRa:SLENgth....372
[:SOURce<hw>]:BB:EUTRa:WAVeform:CREate....372
[:SOURce]:BB:EUTRa:VERSion?....373

**[:SOURce<hw>]:BB:EUTRa:STATe** <State>

Activates modulation in accordance with the EUTRA/LTE standard. Activating this standard deactivates all the other digital standards and digital modulation modes.

In case of two-path instruments, this affects the same path.

**Note:** For two path instruments and configured antenna for for path B from inside path A, enabling the LTE signal simulation will disable all other digital standards and digital modulation modes even in the path B.

`BB:EUTR:STAT ON` deactivates the other standards and digital modulation.

**Parameters:**

<State> ON | OFF

*RST: OFF

**Example:** `BB:EUTR:STAT ON`
activates modulation in accordance with the EUTRA/LTE standard.

**Manual operation:** See "State" on page 76

**[:SOURce<hw>]:BB:EUTRa:DUPLexing** <Duplexing>

Selects the duplexing mode. The duplexing mode determines how the uplink and downlink signal are separated.

**Parameters:**

<Duplexing> TDD | FDD

**TDD**
The same frequency is used for both directions of transmission (uplink and downlink). With one baseband, either only downlink or only uplink signals can be generated.

**FDD**
Different frequencies are used for downlink and uplink directions.

*RST: FDD

**Example:** `BB:EUTR:DUPL FDD`
selects frequency division duplexing.

**Manual operation:** See "Duplexing" on page 78

**[:SOURce<hw>]:BB:EUTRa:LINK** <Link>

Defines the transmission direction. The signal either corresponds to that of a base station (`DOWN`) or that of a subscriber station (`UP`).

**Parameters:**

<Link> DOWN | UP

*RST: DOWN

**Example:** `BB:EUTR:LINK DOWN`
the transmission direction selected is base station to subscriber station. The signal corresponds to that of a base station.

**Manual operation:** See "Link Direction" on page 78

**[:SOURce<hw>]:BB:EUTRa:PRESet**

The command produces a standardized default for the EUTRA/LTE standard. The settings correspond to the `*RST` values specified for the commands.

All EUTRA/LTE settings are preset.

**Example:** `BB:EUTR:PRES`
resets all the EUTRA/LTE settings to default values.

**Manual operation:** See "Set to Default" on page 76

**[:SOURce<hw>]:BB:EUTRa:SETTing:CATalog** <Catalog>

This command reads out the files with EUTRA/LTE settings in the default directory. The default directory is set using command `MMEM:CDIRectory`. Only files with the file extension `*.eutra` will be listed.

**Parameters:**

<Catalog> string

**Example:** `MMEM:CDIR '/var/user/temp/eutra'`
sets the default directory to `/var/user/temp/eutra`.
`BB:EUTR:SETT:CAT?`
reads out all the files with EUTRA/LTE settings in the default directory.
`Response:'eutra1','eutra2'`
the files `eutra1` and `eutra2` are available.

**Manual operation:** See "Save/Recall" on page 77

**[:SOURce<hw>]:BB:EUTRa:SETTing:DEL** <Filename>

Deletes the selected file with EUTRA/LTE settings. The directory is set using command `MMEM:CDIRectory`. A path can also be specified, in which case the files in the specified directory are read. The file extension may be omitted. Only files with the file extension `*.eutra` will be deleted.

**Setting parameters:**

<Filename> <file name>

**Example:** `BB:EUTR:SETT:DEL 'eutra_1'`
deletes file `eutra_1`.

**Usage:** Setting only

**Manual operation:** See "Save/Recall" on page 77

**[:SOURce<hw>]:BB:EUTRa:SETTing:LOAD** <Filename>

Loads the selected file with EUTRA/LTE settings. The directory is set using command `MMEM:CDIRectory`. A path can also be specified, in which case the files in the specified directory are read. The file extension may be omitted. Only files with the file extension `*.eutra` will be loaded.

**Parameters:**

<Filename> string

**Example:** `BB:EUTR:SETT:LOAD 'eutra_1'`
loads file `eutra_1`.

**Manual operation:** See "Save/Recall" on page 77

**[:SOURce<hw>]:BB:EUTRa:SETTing:STORe** <Filename>

Stores the current EUTRA/LTE settings into the selected file. The directory is set using command `MMEM:CDIRectory`. A path can also be specified, in which case the files in the specified directory are read. Only the file name has to be entered. EUTRA/LTE settings are stored as files with the specific file extension `*.eutra`.

**Parameters:**

<Filename> string

**Example:** `BB:EUTR:SETT:STOR 'eutra_1'`
stores the current settings into file `eutra_1`.

**Manual operation:** See "Save/Recall" on page 77

**[:SOURce<hw>]:BB:EUTRa:SETTing:STORe:FAST** <State>

Determines whether the instrument performs an absolute or a differential storing of the settings.

Enable this function to accelerate the saving process by saving only the settings with values different to the default ones.

**Note:** This function is not affected by the "Preset" function.

**Parameters:**
<State> 0 | 1 | OFF | ON
*RST: ON

---

**[:SOURce<hw>]:BB:EUTRa:SETTing:TMOD:TDD** <Tdd>
**[:SOURce<hw>]:BB:EUTRa:SETTing:TMOD:DL** <Filename>

The command selects an EUTRA test model (E-TM) defined by the standard for the downlink.

**Parameters:**
<Filename> <test_model_name>

**Example:** `BB:EUTR:SETT:TMOD:DL 'E-TM1_1__20MHz'`
selects the test model.

**Manual operation:** See "EUTRA Test Models (E-TM) Downlink" on page 105

---

**[:SOURce<hw>]:BB:EUTRa:SLENgth** <SLength>

Sets the sequence length of the signal in number of frames. The signal is calculated in advance and output in the arbitrary waveform generator. The maximum number of frames is calculated as follows:

Max. No. of Frames = Arbitrary waveform memory size/(sampling rate x 10 ms).

**Parameters:**
<SLength> integer
Range: 1 to Max. No. of Frames
Increment: 1
*RST: 1

**Example:** `BB:EUTR:SLEN 4`
selects the generation of 4 frames.

**Manual operation:** See "Sequence Length ARB" on page 267

---

**[:SOURce<hw>]:BB:EUTRa:WAVeform:CREate** <Filename>

This command creates a waveform using the current settings of the "EUTRA/LTE" menu. The file name is entered with the command. The file is stored with the predefined file extension `*.wv`. The file name and the directory it is stored in are user-definable.

**Note:** Even for enabled Realtime Feedback, the waveform file is generated as if this functionality is disabled.

**Note:** The sequence length of the generated ARB file is determined by the selected SFN restart period (`[:SOURce<hw>]:BB:EUTRa:DL:PBCH:SRPeriod`).

**Setting parameters:**
<Filename> string

**Example:** `MMEM:CDIR '/var/user/temp/waveform'`
sets the default directory to `/var/user/temp/waveform`.
`BB:EUTR:WAV:CRE 'eutra_1'`
creates the waveform file `eutra_1.wv` in the default directory.

**Usage:** Setting only

**Manual operation:** See "Generate Waveform File" on page 77

---

**[:SOURce]:BB:EUTRa:VERSion?**

The command queries the version of the 3GPP standard underlying the definitions.

**Return values:**
<Version> string

**Example:** `BB:EUTR:VERS?`
queries the 3GPP version.

**Usage:** Query only

## 9.2 Filter/Clipping/Power Settings

### 9.2.1 Filter Settings

[:SOURce<hw>]:BB:EUTRa:FILTer:TYPE....374
[:SOURce<hw>]:BB:EUTRa:FILTer:MODE....374
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:APCO25....374
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:COSine....374
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:COSine:COFS....375
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:GAUSs....375
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LPASs....375
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LPASSEVM....376
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LTE:COFFactor....376
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LTE:COFS....376
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LTE:OPTimization....376
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LTE:ROFactor....377
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:PGAuss....377
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:RCOSine....377
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:SPHase....378
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:USER....378
[:SOURce<hw>]:BB:EUTRa:SRATe:VARiation....378

**[:SOURce<hw>]:BB:EUTRa:FILTer:TYPE** <Type>

Selects the baseband filter type.

**Parameters:**

<Type> RCOSine | COSine | GAUSs | LGAuss | CONE | COF705 | COEQualizer | COFequalizer | C2K3x | RECTangle | PGAuss | LPASs | DIRac | ENPShape | EWPShape | LTEFilter | LPASSEVM | SPHase | APCO25 | USER

*RST: COSine

**Example:** `BB:EUTR:FILT:TYPE COS`
sets the baseband filter type.

**Manual operation:** See "Filter" on page 263

**[:SOURce<hw>]:BB:EUTRa:FILTer:MODE** <OptMode>

Selects an offline or realtime filter mode.

**Parameters:**

<OptMode> RTime | OFFLine

*RST: RTime

**Example:** `BB:EUTR:FILT:MODE RT`
selects real time filter mode.

**Manual operation:** See "Filter Mode" on page 265

**[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:APCO25** <Apco25>

Sets the roll-off factor for the APCO25 filter type.

**Parameters:**

<Apco25> float

Range: 0.05 to 0.99
Increment: 0.01
*RST: 0.20

**Example:** `BB:EUTR:FILT:PAR:APCO25 0.06`
the roll-off factor is set to 0.06.

**Manual operation:** See "Roll Off Factor or BxT" on page 264

**[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:COSine** <Cosine>

Sets the roll-off factor for the Cosine filter type.

**Parameters:**

<Cosine> float

Range: 0.00 to 0.99
Increment: 0.01
*RST: 0.10

**Example:** `BB:EUTR:FILT:PAR:COS 0.4`
the roll-off factor is set to 0.4.

**Manual operation:** See "Roll Off Factor or BxT" on page 264

---

**[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:COSine:COFS** <Cofs>

Sets the "cut of frequency shift" value for the Cosine filter type.

**Parameters:**
<Cofs> float

Range: -1.0 to 1.0
Increment: 0.01
*RST: -0.20

**Example:** `BB:EUTR:FILT:PAR:COS:COFS 0.04`
the "cut of frequency shift" value is set to 0.04.

**Manual operation:** See "Cut Off Frequency Shift" on page 264

---

**[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:GAUSs** <Gauss>

Sets the BxT for the Gauss filter type (FSK).

**Parameters:**
<Gauss> float

Range: 0.15 to 2.5
Increment: 0.01
*RST: 0.50

**Example:** `BB:EUTR:FILT:PAR:GAUS 0.5`
the BxT is set to 0.5.

**Manual operation:** See "Roll Off Factor or BxT" on page 264

---

**[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LPASs** <LPass>

Sets the cut off frequency factor for the Lowpass (ACP optimization) filter type.

**Parameters:**
<LPass> float

Range: 0.05 to 2.0
Increment: 0.01
*RST: 0.50

**Example:** `BB:EUTR:FILT:PAR:LPAS 0.5`
the cut of frequency factor is set to 0.5.

**Manual operation:** See "Cut Off Frequency Factor" on page 265

**[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LPASSEVM** <CutoffFrequency>

Sets the cut off frequency factor for the Lowpass filter (EVM optimization) type.

**Parameters:**

<CutoffFrequency> float

Range: 0.05 to 2.0
Increment: 0.01
*RST: 0.5

**Example:** `BB:EUTR:FILT:PAR:LPASSEVM 0.5`
the cut of frequency factor is set to 0.5.

**Manual operation:** See "Cut Off Frequency Factor" on page 265

**[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LTE:COFFactor** <CutoffFactor>

Sets the cut off frequency factor for the LTE filter type.

**Parameters:**

<CutoffFactor> float

Range: 0.05 to 2.00
Increment: 0.01
*RST: 0.34

**Example:** `BB:EUTR:FILT:PAR:LTE:COFF 0.35`
the cut-off frequency factor is set to 0.35.

**Manual operation:** See "Cut Off Frequency Factor" on page 265

**[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LTE:COFS** <CutOffFreqShift>

Sets the "cut of frequency shift" value for the LTE filter type.

**Parameters:**

<CutOffFreqShift> float

Range: -1.0 to 1.0
Increment: 0.01
*RST: -0.35 (BW 1.25/1.4/2.5MHz); -0.39 (BW 3MHz); -0.33 (BW 5Mz); -0.34 (BW 10MHz); -0.26 (BW 15MHz); -0.34 (BW 20MHz)

**Example:** `BB:EUTR:FILT:PAR:LTE:COFS -0.3`
the cut-off frequency shift is set to -0.3.

**Manual operation:** See "Cut Off Frequency Shift" on page 264

**[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LTE:OPTimization** <Optimization>

Defines the applied EUTRA/LTE filter. Available are `EVM`, `ACP`, `ACPN` (ACP Narrow) and `BENU` (Best EVM, no upsampling).

**Parameters:**

<Optimization> EVM | ACP | ACPN | BENU

*RST: EVM

**Example:** `BB:EUTR:FILT:PAR:LTE:OPT ACPN`
selects ACP (Narrow) optimization.

**Manual operation:** See "Optimization" on page 263

---

**[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LTE:ROFactor** <RollOffFactor>

Sets the roll-off factor for the LTE filter type.

**Parameters:**

<RollOffFactor> float

Range: 0.00 to 1.0
Increment: 0.01
*RST: 0.1

**Example:** `BB:EUTR:FILT:PAR:LTE:ROF 0.2`
the roll-off factor is set to 0.2.

**Manual operation:** See "Roll Off Factor or BxT" on page 264

---

**[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:PGAuss** <PGauss>

Sets the BxT for the Gauss filter type (pure).

**Parameters:**

<PGauss> float

Range: 0.15 to 2.50
Increment: 0.01
*RST: 0.50

**Example:** `BB:EUTR:FILT:PAR:PGA 0.5`
the BxT is set to 0.5.

**Manual operation:** See "Roll Off Factor or BxT" on page 264

---

**[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:RCOSine** <RCosine>

Sets the roll-off factor for the Root Cosine filter type.

**Parameters:**

<RCosine> float

Range: 0.0 to 1.0
Increment: 0.01
*RST: 0.22

**Example:** `BB:EUTR:FILT:PAR:RCOS 0.4`
the roll-off factor is set to 0.4.

**Manual operation:** See "Roll Off Factor or BxT" on page 264

**[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:SPHase** <SPhase>

Sets the BxT for the Split Phase filter type.

**Parameters:**

<SPhase> float

Range: 0.15 to 2.5
Increment: 0.01
*RST: 2.00

**Example:** `BB:EUTR:FILT:PAR:SPH 2`
the BxT is set to 2.0

**Manual operation:** See "Roll Off Factor or BxT" on page 264

**[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:USER** <Filename>

The command selects the user-defined filter (`*.vaf`).

The directory applicable to the following command is defined with the command `MMEMory:CDIR`. To access the files in this directory, only the file name is required, without the path and the file extension.

**Parameters:**

<Filename> string

**Example:** `BB:EUTR:FILT:TYPE USER`
selects the User filter type.
`MMEM:CDIR '/var/user/temp/Filter_List'`
selects the directory for the user-defined filters.
`BB:EUTR:FILT:PAR:USER eutra_user_filter`
selects the user-defined filter.

**Manual operation:** See "Load User Filter" on page 264

**[:SOURce<hw>]:BB:EUTRa:SRATe:VARiation** <Variation>

Enters the output sample rate.

A variation of this parameter only affects the ARB clock rate; all other signal parameters remain unchanged. If the sampling rate in the "General Settings" menu is changed, this parameter is reset to the chosen sampling rate.

**Parameters:**

<Variation> float

Range: 400Hz to 40MHz
Increment: 0.001Hz
*RST: 15.36MHz
Default unit: Hz

**Example:** `BB:EUTR:SRAT:VAR 400Hz`
sets the output sample rate to 400 Hz.

**Manual operation:** See "Sample Rate Variation " on page 265

### 9.2.2 Clipping Settings

[:SOURce<hw>]:BB:EUTRa:CLIPping:LEVel....379
[:SOURce<hw>]:BB:EUTRa:CLIPping:MODE....379
[:SOURce<hw>]:BB:EUTRa:CLIPping:STATe....380

**[:SOURce<hw>]:BB:EUTRa:CLIPping:LEVel** <Level>

Sets the limit for level clipping. This value indicates at what point the signal is clipped. It is specified as a percentage, relative to the highest level. 100% indicates that clipping does not take place.

Level clipping is activated with the command `BB:EUTR:CLIP:STAT ON`

**Parameters:**

<Level> integer

Range: 0PCT to 100PCT
Increment: 1PCT
*RST: 100PCT

**Example:** `BB:EUTR:CLIP:LEV 80PCT`
sets the limit for level clipping to 80% of the maximum level.
`BB:EUTR:CLIP:STAT ON`
activates level clipping.

**Manual operation:** See "Clipping Level" on page 266

**[:SOURce<hw>]:BB:EUTRa:CLIPping:MODE** <Mode>

Sets the method for level clipping.

**Parameters:**

<Mode> VECTor | SCALar

**VECTor**
The reference level is the amplitude | i+jq |.

**SCALar**
The reference level is the absolute maximum of the I and Q values.

*RST: VECT

**Example:** `BB:EUTR:CLIP:MODE SCAL`
selects the absolute maximum of all the I and Q values as the reference level.
`BB:EUTR:CLIP:LEV 80PCT`
sets the limit for level clipping to 80% of this maximum level.
`BB:EUTR:CLIP:STAT ON`
activates level clipping.

**Manual operation:** See "Clipping Mode" on page 267

**[:SOURce<hw>]:BB:EUTRa:CLIPping:STATe** <State>

Activates level clipping (Clipping). The value is defined with the command `[SOURce:]BB:EUTRa:CLIPping:LEVel`, the mode of calculation with the command `[SOURce:]BB:EUTRa:CLIPping:MODE`.

**Parameters:**

<State> ON | OFF
*RST: OFF

**Example:** `BB:EUTR:CLIP:STAT ON`
activates level clipping.

**Manual operation:** See "Clipping State" on page 266

### 9.2.3 Time Domain Windowing Settings

**[:SOURce<hw>]:BB:EUTRa:TDW:STATe** <State>

Activates/deactivates the time domain windowing.

**Parameters:**

<State> ON | OFF
*RST: OFF

**Example:** `BB:EUTR:TDW:STAT ON`
activates time domain windowing.

**Manual operation:** See "State (Time Domain Windowing)" on page 268

**[:SOURce<hw>]:BB:EUTRa:TDW:TRTime** <TransitionTime>

Sets the transition time when time domain windowing is active.

**Parameters:**

<TransitionTime> float
Range: 0.0us to 10.0us
Increment: 0.1us
*RST: 5.0us

**Example:** `BB:EUTR:TDW:TDT 2us`
sets ths transition time to 2us.

**Manual operation:** See "Transition Time" on page 268

### 9.2.4 Power Settings

[:SOURce<hw>]:BB:EUTRa:POWC:LEVReference....381
[:SOURce<hw>]:BB:EUTRa:POWC:REFChannel....381
[:SOURce<hw>]:BB:EUTRa:POWC:REFSubframe?....381
[:SOURce<hw>]:BB:EUTRa:POWC:RUE?....382

**[:SOURce<hw>]:BB:EUTRa:POWC:LEVReference** <LevelReference>

Defines the reference the "Level" display in the status bar is referring to.

**Parameters:**

<LevelReference> FRMS | DRMS | URMS | UEBurst

**FRMS**
The displayed RMS and PEP are measured during the whole frame.
All frames are considered, not only the first one.

**DRMS**
The displayed RMS and PEP are measured during the DL part of the frame (all DL subframes and the DwPTS).
All frames are considered, not only the first one.

**URMS**
The displayed RMS and PEP are measured during the UL part of the frame (all UL subframes and the UpPTS).
All frames are considered, not only the first one.

**UEBurst**
The displayed RMS and PEP are measured during a single subframe of a certain UE.

*RST: FRMS

**Example:** `BB:EUTR:POWC:LEVR UEB`
sets level reference to UE Burst RMS Power

**Manual operation:** See "Power Reference" on page 269

**[:SOURce<hw>]:BB:EUTRa:POWC:REFChannel** <RefChannel>

Queries the channel type the measured RMS and PEP is referring to, if the Level Reference is set to "UE Burst RMS Power"

**Parameters:**

<RefChannel> NF | PUSCH | PUCCH | PRACH | SRS | PUCPUS

*RST: NF

**Example:** `BB:EUTR:POWC:LEVR UEB`
sets level reference to UE Burst RMS Power
`BB:EUTR:POWC:RUE?`
queries the channel type

**Manual operation:** See "Reference Channel" on page 270

**[:SOURce<hw>]:BB:EUTRa:POWC:REFSubframe?**

Queries the subframe the measured RMS and PEP is referring to, if the Level Reference is set to "UE Burst RMS Power"

**Return values:**
<RefSubframe> integer
Range: 0 to 39
Increment: 1
*RST: 0

**Example:** `BB:EUTR:POWC:LEVR UEB`
sets level reference to UE Burst RMS Power
`BB:EUTR:POWC:REFS?`
queries the reference subframe

**Usage:** Query only

**Manual operation:** See "Reference Subframe" on page 270

---

**[:SOURce<hw>]:BB:EUTRa:POWC:RUE?**

Queries the UE the measured RMS and PEP is referring to, if the Level Reference is set to "UE Burst RMS Power".

**Return values:**
<ReferenceUe> UE1 | UE2 | UE3 | UE4
*RST: UE1

**Example:** `BB:EUTR:POWC:LEVR UEB`
sets level reference to UE Burst RMS Power
`BB:EUTR:POWC:RUE?`
queries the reference UE

**Usage:** Query only

**Manual operation:** See "Reference UE" on page 270

## 9.3 Clock Settings

This section lists the remote control commands, necessary to configure the clock.

[:SOURce<hw>]:BB:EUTRa:CLOCk:MODE....382
[:SOURce<hw>]:BB:EUTRa:CLOCk:CUSTom....383
[:SOURce<hw>]:BB:EUTRa:CLOCk:SOURce....383
[:SOURce<hw>]:BB:EUTRa:CLOCk:MULTiplier....384

---

**[:SOURce<hw>]:BB:EUTRa:CLOCk:MODE** <Mode>

Enters the type of externally supplied clock (`BB:EUTRa:CLOCk:SOURce EXTernal`).

**Parameters:**

<Mode> SAMP | MSAMp

**SAMPle**
The sample clock is supplied via the correspondent clock connector.

**MSAMple**
A multiple of the clock is supplied and the clock is derived internally from it.The multiplier is entered with the command `BB:EUTRa:CLOCk:MULTiplier`.

*RST: SAMP

**Example:** `BB:EUTR:CLOC:MODE SAMP`
selects clock type "SAMPle", i.e. the supplied clock is a sample clock.

**Manual operation:** See "Clock Mode" on page 89

---

**[:SOURce<hw>]:BB:EUTRa:CLOCk:CUSTom** <Custom>

Specifies the sample clock for clock type Custom (`BB:EUTRa:CLOCk:MODE CUSTom`) in the case of an external clock source.

**Note:** Custom External Clock source in baseband B is only supported if baseband A is configured with EUTRA/LTE too. Furthermore the same settings for clock source and clock mode have to be set in baseband A and B. The user needs to take care of the correct settings.

**Parameters:**

<Custom> integer

Range: 25000 to 40E6
*RST: 38.4E6

**Example:** `BB:EUTR:CLOC:SOUR EXT`
selects an external clock reference.
`BB:EUTR:CLOC:MODE CUSTom`
selects clock type Custom.
`BB:EUTR:CLOC:CUSTom 38400000`
the custom external clock is 38.4MHz.

**Manual operation:** See "Custom External Clock" on page 89

---

**[:SOURce<hw>]:BB:EUTRa:CLOCk:SOURce** <Source>

Selects the clock source.

**Parameters:**

<Source> INTernal | EGC1 | EGC2 | ELCLock | EXTernal

**INTernal**
The instrument uses its internal clock reference

**EGC1|EGC2**
External global clock

**ELCLock**
External local clock

*RST: INTernal

**Example:** `BB:EUTR:CLOC:SOUR: INT`
selects an internal clock reference.

**Manual operation:** See "Clock Source" on page 88

---

**[:SOURce<hw>]:BB:EUTRa:CLOCk:MULTiplier** <Multiplier>

Specifies the multiplier for clock type "Multiplied" (`BB:EUTRa:CLOCk:MODE MSAMple`) in the case of an external clock source.

**Parameters:**

<Multiplier> integer

Range: 1 to 64
Increment: 1
*RST: 4

**Example:** `BB:EUTR:CLOC:SOUR EXT`
selects the external clock source.
`BB:EUTR:CLOC:MODE MSAM`
selects clock type "Multiplied", i.e. the supplied clock has a rate which is a multiple of the sample rate.
`BB:EUTR:CLOC:MULT 12`
the multiplier for the external clock rate is 12.

**Manual operation:** See "Clock Multiplier" on page 89

## 9.4 Timing Configuration

---

**[:SOURce<hw>]:BB:EUTRa:TIMC:NTAoffset** <NtaOffset>

Sets the parameter $N_{TA\ offset}$ as defined in the 3GPP TS 36.211.

**Parameters:**

<NtaOffset> NTA0 | NTA624 | 0

*RST: NTA0

**Example:** `BB:EUTR:TIMC:NTA NTA0`
sets parameter $N_{TA\ offset}$

**Manual operation:** See "Signal Advance N_TA_offset" on page 84

## 9.5 Trigger Settings

This section lists the remote control commands, necessary to configure the trigger.

[:SOURce<hw>]:BB:EUTRa[:TRIGger]:SEQuence....385
[:SOURce<hw>]:BB:EUTRa:TRIGger:ARM:EXECute....386
[:SOURce<hw>]:BB:EUTRa:TRIGger:DELay:UNIT....387
[:SOURce<hw>]:BB:EUTRa:TRIGger:EXECute....387
[:SOURce<hw>]:BB:EUTRa:TRIGger:EXTernal<ch>:RDELay?....387
[:SOURce<hw>]:BB:EUTRa:TRIGger:EXTernal<ch>:TDELay....388
[:SOURce<hw>]:BB:EUTRa:TRIGger:EXTernal:SYNChronize:OUTPut....388
[:SOURce<hw>]:BB:EUTRa:TRIGger:OBASeband:DELay....389
[:SOURce<hw>]:BB:EUTRa:TRIGger:OBASeband:INHibit....389
[:SOURce<hw>]:BB:EUTRa:TRIGger:OBASeband:RDELay?....389
[:SOURce<hw>]:BB:EUTRa:TRIGger:OBASeband:TDELay....390
[:SOURce<hw>]:BB:EUTRa:TRIGger:RMODe?....390
[:SOURce<hw>]:BB:EUTRa:TRIGger:SLENgth....391
[:SOURce<hw>]:BB:EUTRa:TRIGger:SLUNit....391
[:SOURce<hw>]:BB:EUTRa:TRIGger:SOURce....392
[:SOURce<hw>]:BB:EUTRa:TRIGger[:EXTernal]:DELay....393
[:SOURce<hw>]:BB:EUTRa:TRIGger[:EXTernal]:INHibit....394
[:SOURce<hw>]:BB:EUTRa:TRIGger:EXTernal:RDELay?....394
[:SOURce<hw>]:BB:EUTRa:TRIGger:EXTernal:TDELay....394

---

**[:SOURce<hw>]:BB:EUTRa[:TRIGger]:SEQuence** <TriggerMode>

Selects the trigger mode.

**Parameters:**

<TriggerMode> AUTO | RETRigger | AAUTo | ARETrigger | SINGle

**AUTO**
The modulation signal is generated continuously.

**RETRigger**
The modulation signal is generated continuously. A trigger event (internal or external) causes a restart.

**AAUTo**
The modulation signal is generated only when a trigger event occurs. After the trigger event the signal is generated continuously. Signal generation is stopped with command `BB:EUTR:TRIG:ARM:EXEC` and started again when a trigger event occurs.
This mode is used for example for Base Station Tests if a frame marker from the device under test starts the signal output. Subsequent frame markers will not cause a restart of the signal.

**ARETrigger**
The modulation signal is generated only when a trigger event occurs. The device automatically toggles to `RETR` mode. Every subsequent trigger event causes a restart.
Signal generation is stopped with command `BB:EUTR:TRIG:ARM:EXEC` and started again when a trigger event occurs.

**SINGle**
The modulation signal is generated only when a trigger event occurs. Then the signal is generated once to the length specified with command `BB:EUTR:TRIG:SLEN`. Every subsequent trigger event causes a restart.

*RST: AUTO

**Example:** `BB:EUTR:SEQ AAUT`
sets the "Armed_auto" trigger mode; the device waits for the first trigger (e.g. with `*TRG`) and then generates the signal continuously.

**Manual operation:** See "Trigger Mode" on page 81

---

**[:SOURce<hw>]:BB:EUTRa:TRIGger:ARM:EXECute**

Stops signal generation for trigger modes "Armed_Auto" and "Armed_Retrigger". A subsequent internal or external trigger event restarts signal generation.

**Example:** `BB:EUTR:TRIG:SOUR INT`
sets internal triggering.
`BB:EUTR:TRIG:SEQ ARET`
sets Armed_Retrigger mode, i.e. every trigger event causes signal generation to restart.
`BB:EUTR:TRIG:EXEC`
executes a trigger, signal generation is started.
`BB:EUTR:TRIG:ARM:EXEC`
signal generation is stopped.
`BB:EUTR:TRIG:EXEC`
executes a trigger, signal generation is started again.

**Usage:** Event

**Manual operation:** See "Arm" on page 82

---

**[:SOURce<hw>]:BB:EUTRa:TRIGger:DELay:UNIT** <DelUnit>

Defines the unit of the external and other baseband trigger delay.

**Parameters:**
<DelUnit> SAMPle | TIME
Range: eIdEUtraDelUnitSample to eIdEUtraDelUnitTime
*RST: eIdEUtraDelUnitSample

**Example:** `BB:EUTR:TRIG:DEL:UNIT SAMP`
sets the external trigger delay to samples.

**Manual operation:** See "External Delay Unit" on page 83

---

**[:SOURce<hw>]:BB:EUTRa:TRIGger:EXECute**

Executes a trigger. The internal trigger source must be selected using the command `BB:EUTR:TRIG:SOUR INT` and a trigger mode other than AUTO must be selected using the command `BB:EUTR:TRIG:SEQ`.

**Example:** `BB:EUTR:TRIG:SOUR INT`
sets internal triggering.
`BB:EUTR:TRIG:SEQ RETR`
sets Retrigger mode, i.e. every trigger event causes signal generation to restart.
`BB:EUTR:TRIG:EXEC`
executes a trigger.

**Usage:** Event

**Manual operation:** See "Execute Trigger" on page 82

---

**[:SOURce<hw>]:BB:EUTRa:TRIGger:EXTernal<ch>:RDELay?**

Queries the actual external trigger delay (expressed in time unit).

**Return values:**
<ExtResultDelay> float
Range: 0 to 688
Increment: 250E-12
*RST: 0

**Example:** `BB:EUTR:TRIG:EXT:RDEL?`
Response: `5.12E-6` the resulting delay of the external trigger signal is 5.12 micro seconds.

**Usage:** Query only

**Manual operation:** See "Actual External Delay" on page 84

---

**[:SOURce<hw>]:BB:EUTRa:TRIGger:EXTernal<ch>:TDELay** <Delay>

Defines the trigger delay (expressed in time units) for external triggering.

**Parameters:**
<Delay> float
Range: 0 to 688
Increment: 250E-12
*RST: 0

**Example:** `BB:EUTR:TRIG:EXT:TDEL 5E-6`
sets a delay of 5 micro seconds for the trigger.

**Manual operation:** See "External Trigger Delay" on page 84

---

**[:SOURce<hw>]:BB:EUTRa:TRIGger:EXTernal:SYNChronize:OUTPut** <OutputState>

(enabled for Trigger Source External)

Enables/disables output of the signal synchronous to the external trigger event.

**Parameters:**
<OutputState> ON | OFF

**ON**
The signal calculation starts simultaneously with the external trigger event but because of the instrument's processing time the first samples are cut off and no signal is outputted. After elapsing of the internal processing time, the output signal is synchronous to the trigger event.

**OFF**
The signal output begins after elapsing of the processing time and starts with sample 0, i.e. the complete signal is outputted.

*RST: ON

**Example:** `BB:EUTR:TRIG:SOUR EXT`
sets external triggering.
`BB:EUTR:TRIG:EXT:SYNC:OUTP ON`
enables synchrounous output to external trigger

**Manual operation:** See "Sync. Output to External Trigger" on page 83

---

**[:SOURce<hw>]:BB:EUTRa:TRIGger:OBASeband:DELay** <Delay>

Specifies the trigger delay (expressed as a number of samples) for triggering by the trigger signal from the second path (two-path instruments only).

**Parameters:**
<Delay> integer
Range: 0 to 65535
Increment: 1
*RST: 0

**Example:** `BB:EUTR:TRIG:SOUR OBAS`
sets for path A the internal trigger executed by the trigger signal from the second path (path B).
`BB:EUTR:TRIG:OBAS:DEL 50`
sets a delay of 50 samples for the trigger.

**Manual operation:** See "External Trigger Delay" on page 84

---

**[:SOURce<hw>]:BB:EUTRa:TRIGger:OBASeband:INHibit** <Inhibit>

Specifies the number of samples by which a restart is to be inhibited following a trigger event. This command applies only for triggering by the second path.

**Parameters:**
<Inhibit> integer
Range: 0 to 2^26-1
Increment: 1
*RST: 0

**Example:** `BB:EUTR:TRIG:SOUR OBAS`
sets for path A the internal trigger executed by the trigger signal from the second path (path B).
`BB:EUTR:TRIG:OBAS:INH 200`
sets a restart inhibit for 200 samples following a trigger event.

**Manual operation:** See "External Trigger Inhibit" on page 84

---

**[:SOURce<hw>]:BB:EUTRa:TRIGger:OBASeband:RDELay?**

Queries the actual trigger delay (expressed in time units) of the trigger signal from the second path (two-path instruments only).

**Return values:**

<IntOthRDelay> float

Range: 0 to 688
Increment: 250E-12
*RST: 0

**Example:** `BB:EUTR:TRIG:SOUR OBAS`
sets for path A the internal trigger executed by the trigger signal from the second path (path B).
`BB:EUTR:TRIG:OBAS:RDEL?`
Response: `3.2E-6` the resulting delay of the internal trigger signal is 3.2 micro seconds.

**Usage:** Query only

**Manual operation:** See "Actual External Delay" on page 84

---

**[:SOURce<hw>]:BB:EUTRa:TRIGger:OBASeband:TDELay** <IntOthTDelay>

Specifies the trigger delay (expressed in time units) for triggering by the trigger signal from the second path (two-path instruments only).

**Parameters:**

<IntOthTDelay> float

Range: 0 to 688
Increment: 250E-12
*RST: 0

**Example:** `BB:EUTR:TRIG:SOUR OBAS`
sets for path A the internal trigger executed by the trigger signal from the second path (path B).
`BB:EUTR:TRIG:OBAS:TDEL 1.5E-6`
sets a delay of 1.5 micro seconds for the trigger.

**Manual operation:** See "External Trigger Delay" on page 84

---

**[:SOURce<hw>]:BB:EUTRa:TRIGger:RMODe?**

The command queries the current status of signal generation for all trigger modes with EUTRA/LTE modulation on.

**Return values:**

<RunMode> RUN | STOP

**RUN**
the signal is generated. A trigger event occurred in the triggered mode.

**STOP**
the signal is not generated. A trigger event did not occur in the triggered modes, or signal generation was stopped by the command `BB:EUTRa:TRIG:ARM:EXECute` (armed trigger modes only).

**Example:** `BB:EUTR:TRIG:SOUR EXT`
sets external triggering .
`BB:EUTR:TRIG:SEQ ARET`
selects the Armed_Retrigger mode.
`BB:EUTR:TRIG:RMOD?`
queries the current status of signal generation.
`Response: RUN`
the signal is generated, an external trigger was executed.

**Usage:** Query only

**Manual operation:** See "Running/Stopped" on page 81

---

**[:SOURce<hw>]:BB:EUTRa:TRIGger:SLENgth** <SequenceLength>

Defines the length of the signal sequence to be output in the "Single" trigger mode (`BB:EUTRa:TRIG:SEQ SING`).

It is possible to output deliberately just part of the frame, an exact sequence of the frame, or a defined number of repetitions of the frame. The unit is defined with command `BB:EUTRa:TRIG:SLUNit`. If the selected unit is changed, the selected sequence length will be automatically recalculated in the new unit.

**Parameters:**

<SequenceLength> integer

Range: 1 to 4294967295
*RST: 1

**Example:** `BB:EUTR:TRIG:SEQ SING`
sets the trigger mode Single.
`BB:EUTR:TRIG:SLUN FRAM`
sets the unit Frame length for the entry of the sequence length.
`BB:EUTR:TRIG:SLEN 200`
sets a sequence length of 200 frames. The first 200 samples of the current frame will be output after the next trigger event.
`BB:EUTR:TRIG:SLUN SLOT`
sets the unit slot length for the entry of the sequence length
`BB:EUTR:TRIG:SLEN?`
queries the sequence length.
`Response: 40`

**Manual operation:** See "Trigger Signal Duration" on page 81

---

**[:SOURce<hw>]:BB:EUTRa:TRIGger:SLUNit** <SeqLenUnit>

Defines the unit for the entry of the length of the signal sequence (`BB:EUTRa:TRIG:SLEN`) to be output in the "Single" trigger mode (`BB:EUTRa:TRIG:SEQ SING`).

**Parameters:**

<SeqLenUnit> SEQuence | FRAMe | SUBFrame | SLOT | SAMPle

**FRAMe**
Unit Frame. A single frame is generated after a trigger event.

**SEQuence**
Unit Sequence Length. A single sequence is generated after a trigger event.

**SUBFrame**
Unit Subframe. A single subframe is generated after a trigger event.

**SLOT**
Unit Slot. A single slot is generated after a trigger event.

**SAMPle**
Unit Sample. Number of samples are generated after a trigger event.

*RST: SEQuence

**Manual operation:** See "Signal Duration Unit" on page 81

---

**[:SOURce<hw>]:BB:EUTRa:TRIGger:SOURce** <Source>

Selects the trigger signal source and determines the way the triggering is executed. Provided are internal triggering by means of a command, external trigger singnal via one of the provided local or global connectors and and triggering by a signal from the other paths.

**Parameters:**

<Source> INTB | INTernal | OBASeband | EGT1 | EGT2 | EGC1 | EGC2 | ELTRigger | INTA | ELCLock | BEXTernal | EXTernal

**INTernal**
Internal

**INTA | INTB**
Internal trigger from the other baseband

**EGT1 | EGT2**
External global trigger

**EGC1 | EGC2**
External global clock

**ELTRigger**
External local trigger

**ELCLock**
External local clock

**OBASeband|BEXTernal|EXTernal**
Provided only for backward compatibility with other R&S signal generators.
The R&S SMW accepts these values und maps them automatically as follow:
EXTernal = EGT1, BEXTernal = EGT2, OBASeband = INTA or INTB (depending on the current baseband)

*RST: INTernal

**Example:** `BB:EUTR:TRIG:SOUR INT`
selects an internal trigger.

**Manual operation:** See "Trigger Source" on page 82

---

**[:SOURce<hw>]:BB:EUTRa:TRIGger[:EXTernal]:DELay** <Delay>

Specifies the trigger delay (expressed as a number of samples) for external triggering. The value affects all external trigger signals.

**Parameters:**

<Delay> float

Range: 0 to 68719476735
Increment: 0.01
*RST: 0

**Example:** `BB:EUTR:TRIG:SOUR EXT`
sets an external trigger.
`BB:EUTR:TRIG:EXT:DEL 50`
sets a delay of 50 symbols for the trigger.

**Manual operation:** See "External Trigger Delay" on page 84

**[:SOURce<hw>]:BB:EUTRa:TRIGger[:EXTernal]:INHibit** <Inhibit>

Specifies the number of samples by which a restart is to be inhibited following an external trigger event.

**Parameters:**

<Inhibit> integer

Range: 0 to 67108863
*RST: 0

**Example:** `BB:C2K:TRIG:SOUR EXT`
selects an external trigger.
`BB:EUTR:TRIG:EXT:INH 200`
sets a restart inhibit for 200 samples following a trigger event.

**Manual operation:** See "External Trigger Inhibit" on page 84

**[:SOURce<hw>]:BB:EUTRa:TRIGger:EXTernal:RDELay?**

Queries the time (in seconds) of an external trigger event is delayed for.

**Return values:**

<ExtResultDelay> float

Range: 0 to 688
Increment: 250E-12
*RST: 0

**Usage:** Query only

**[:SOURce<hw>]:BB:EUTRa:TRIGger:EXTernal:TDELay** <Delay>

Specifies the trigger delay (in seconds) for external triggering. The value affects all external trigger signals.

**Parameters:**

<Delay> float

Range: 0 to 688
Increment: 250E-12
*RST: 0

## 9.6 Marker Settings

This section lists the remote control commands, necessary to configure the markers.

[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut:DELay:FIXed....395
[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:DELay....395
[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:DELay:MAXimum?....395
[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:DELay:MINimum?....396
[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:MODE....396
[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:FOFFset....398

[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:ROFFset....398
[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:OFFTime....398
[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:ONTime....398
[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:PERiod....398

**[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut:DELay:FIXed** <Fixed>

For R&S SMWinstruments only.

The command restricts the marker delay setting range to the dynamic range. In this range the delay can be set without restarting the marker and signal. If a delay is entered in setting ON but is outside this range, the maximum possible delay is set and an error message is generated.

**Parameters:**

<Fixed> 0 | 1 | OFF | ON

*RST: OFF

**Example:** `BB:EUTR:TRIG:OUTP:DEL:FIX ON`
restricts the marker signal delay setting range to the dynamic range.

**Manual operation:** See "Marker x Delay" on page 87

**[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:DELay** <Delay>

Defines the delay between the signal on the marker outputs and the start of the signal, expressed in terms of samples. Command `BB:EUTRa:TRIGger:OUTPut:DELay:FIXed` can be used to restrict the range of values to the dynamic range, i.e. the range within which a delay of the marker signals can be set without restarting the marker and signal.

**Parameters:**

<Delay> integer

Range: 0 samples to 2^24-1 samples
Increment: 1 sample
*RST: 0 samples

**Example:** `BB:EUTR:TRIG:OUTP2:DEL 1600`
sets a delay of 1600 samples for the corresponding marker signal.

**Manual operation:** See "Marker x Delay" on page 87

**[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:DELay:MAXimum?**

The command queries the maximum marker delay for setting `BB:EUTRa:TRIG:OUTP:DEL:FIX ON`.

**Return values:**

<Maximum> float

Range: 0 to max
Increment: 0.001
*RST: 2000

**Example:** `BB:EUTR:TRIG:OUTP:DEL:FIX ON`
restricts the marker signal delay setting range to the dynamic range.
`BB:EUTR:TRIG:OUTP:DEL:MAX?`
queries the maximum of the dynamic range.
`Response: 20000`
the maximum for the marker delay setting is 2000 samples.

**Usage:** Query only

**Manual operation:** See "Marker x Delay" on page 87

---

**[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:DELay:MINimum?**

The command queries the minimum marker delay for setting `BB:EUTRa:TRIGger:OUTPut:DELay:FIXed ON`.

**Return values:**

<Minimum> float

Range: 0 to max
Increment: 0.001
*RST: 0

**Example:** `BB:EUTR:TRIG:OUTP:DEL:FIX ON`
restricts the marker signal delay setting range to the dynamic range.
`BB:EUTR:TRIG:OUTP:DEL:MIN?`
queries the minimum of the dynamic range.
`Response: 0`
the minimum for the marker delay setting is 0 samples.

**Usage:** Query only

**Manual operation:** See "Marker x Delay" on page 87

---

**[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:MODE** <Mode>

Defines the signal for the selected marker output.

**Parameters:**

<Mode> SUBFram | FRAM | RESTart | PERiod | RATio | FAP

**SUBFram**
A marker signal is generated at the start of each subframe. The rise and fall offsets are defined with the commands `[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:FOFFset` and `[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:ROFFset`.

**FAP**
The marker signal is high whenever a burst is active and low during inactive signal parts (such as the gaps between bursts in uplink mode or the uplink subframe in downlink TDD mode).
This marker can be used to decrease the carrier leakage during inactive signal parts by feeding it into the pulse modulator.

**FRAM**
A marker signal is generated at the start of each radio frame. The rise and fall offsets are defined with the commands `[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:FOFFset` and `[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:ROFFset`.

**RESTart**
A marker signal is generated at the start of each ARB sequence. The rise and fall offsets are defined with the commands `[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:FOFFset` and `[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:ROFFset`.

**PERiod**
A marker signal is generated at the beginning of every user-defined period. The period is defined with the command `[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:PERiod` on page 398.

**RATio**
A marker signal corresponding to the Time Off / Time On specifications in the commands `[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:ONTime` and `[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:OFFTime` is generated.

*RST: FRAM

**Example:**

```
BB:EUTR:TRIG:OUTP:MODE FRAMe
```
selects the frame marker for the corresponding marker signal.

```
BB:EUTR:TRIG:OUTP:ROFF 20
```
sets a rise offset of 20 samples for the corresponding marker signal.

```
BB:EUTR:TRIG:OUTP:FOFF 2000
```
sets a fall offset of 2000 samples for the corresponding marker signal on path A.

**Manual operation:** See "Marker Mode" on page 86

**[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:FOFFset** <FallOffset>
**[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:ROFFset** <RiseOffset>

Sets the rise offset for on/off ratio marker in number of samples.

**Parameters:**

<RiseOffset> integer

Range: -64000 samples to 64000 samples
Increment: 1 sample
*RST: 0 samples

**Example:** `BB:EUTR:TRIG:OUTP2:ROFF 20`
sets a rise offset of 20 samples for marker signal 2.

**Manual operation:** See "Rise/Fall Offset" on page 87

**[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:OFFTime** <OffTime>
**[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:ONTime** <OnTime>

Sets the number of samples in a period (ON time + OFF time) during which the marker signal in setting `BB:EUTR:TRIGger:OUTPut:MODE RATio` on the marker outputs is ON.

**Parameters:**

<OnTime> integer

Range: 1 sample to 2^24-1 samples
Increment: 1 sample
*RST: 1 sample

**Example:** `BB:EUTR:TRIG:OUTP:MODE RAT`
selects the ratio marker for the corresponding marker signal.
`BB:EUTR:TRIG:OUTP:ONT 200`
sets an ON time of 200 samples for the corresponding marker signal.

**Manual operation:** See "Marker Mode" on page 86

**[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:PERiod** <Period>

Sets the repetition rate for the signal at the marker outputs, expressed in terms of samples. The setting is only valid for selection "USER" in `BB:EUTR:TRIG:OUTP:MODE`.

**Parameters:**

<Period> unsigned integer

Range: 1 sample to 2^32-1 samples
Increment: 1 sample
*RST: 2 samples

**Example:** `BB:EUTR:TRIG:OUTP2:MODE PER`
selects the user marker for the corresponding marker signal.
`BB:EUTR:TRIG:OUTP2:PER 1600`
sets a period of 1600 samples, i.e. the marker signal is repeated every 1600th sample.

**Manual operation:** See "Marker Mode" on page 86

## 9.7 General EUTRA/LTE Settings

[:SOURce<hw>]:BB:EUTRa:TDD:SPSConf.....399
[:SOURce<hw>]:BB:EUTRa:TDD:UDConf.....399

---

**[:SOURce<hw>]:BB:EUTRa:TDD:SPSConf** <SpecSubfrConf>

(enabled for TDD duplexing mode only)

Sets the Special Subframe Configuration number, i.e. together with the parameter `[:SOURce<hw>]:BB:EUTRa:DL:CPC` defines the lengths of the DwPTS, the Guard Period and the UpPTS.

**Parameters:**

<SpecSubfrConf> integer

Range: 0 to 8
Increment: 1
*RST: 0

**Example:** `BB:EUTR:TDD:SPSC 2`
sets the special subframe configuration

**Manual operation:** See "Configuration of Special Subframes" on page 136

---

**[:SOURce<hw>]:BB:EUTRa:TDD:UDConf** <ULDLConf>

(enabled for TDD duplexing mode only)

Sets the Uplink-Downlink Configuration number, i.e. defines which subframe is used for downlink respectively uplink, and where the special subframes are located.

**Parameters:**

<ULDLConf> integer

Range: 0 to 6
Increment: 1
*RST: 0

**Example:** `BB:EUTR:TDD:UDC 2`
sets the UL/DL configuration

**Manual operation:** See "UL/DL Configuration" on page 136

## 9.8 General EUTRA/LTE Downlink Settings

[:SOURce<hw>]:BB:EUTRa:DL:CONF:MODE....400
[:SOURce<hw>]:BB:EUTRa:DL:MIMO:CONFiguration....401
[:SOURce<hw>]:BB:EUTRa:DL:MIMO:ANTenna....401
[:SOURce<hw>]:BB:EUTRa:DL:MIMO:ANTA....402
[:SOURce<hw>]:BB:EUTRa:DL:MIMO:ANTB....402
[:SOURce<hw>]:BB:EUTRa:DL:MIMO:APM:CS:AP<dir0>:BB<st0>:REAL....402
[:SOURce<hw>]:BB:EUTRa:DL:MIMO:APM:CS:AP<dir0>:BB<st0>:IMAGinary....402
[:SOURce<hw>]:BB:EUTRa:DL:MIMO:APM:MAPCoordinates....403
[:SOURce<hw>]:BB:EUTRa:DL:REFSig:POWer....403
[:SOURce<hw>]:BB:EUTRa:DL:REFSig:EPRE....403
[:SOURce<hw>]:BB:EUTRa:DL:SYNC:TXANtenna....403
[:SOURce<hw>]:BB:EUTRa:DL:SYNC:PPOWer....404
[:SOURce<hw>]:BB:EUTRa:DL:SYNC:SPOWer....404
[:SOURce<hw>]:BB:EUTRa:DL:BW....404
[:SOURce<hw>]:BB:EUTRa:DL:NORB....404
[:SOURce<hw>]:BB:EUTRa:DL:SRATe?....405
[:SOURce<hw>]:BB:EUTRa:DL:FFT....405
[:SOURce<hw>]:BB:EUTRa:DL:OCCBandwidth?....405
[:SOURce<hw>]:BB:EUTRa:DL:OCCSubcarriers?....406
[:SOURce<hw>]:BB:EUTRa:DL:LGS?....406
[:SOURce<hw>]:BB:EUTRa:DL:RGS?....406
[:SOURce<hw>]:BB:EUTRa:DL[:PLCi]:CID....407
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[:SOURce<hw>]:BB:EUTRa:DL:PHICh:DURation....410
[:SOURce<hw>]:BB:EUTRa:DL:PHICh:NGParameter....411
[:SOURce<hw>]:BB:EUTRa:DL:PRSS:BW....411
[:SOURce<hw>]:BB:EUTRa:DL:PRSS:CI....412
[:SOURce<hw>]:BB:EUTRa:DL:PRSS:DPRS?....412
[:SOURce<hw>]:BB:EUTRa:DL:PRSS:NPRS....412
[:SOURce<hw>]:BB:EUTRa:DL:PRSS:POW....412
[:SOURce<hw>]:BB:EUTRa:DL:PRSS:STATe....413
[:SOURce<hw>]:BB:EUTRa:DL:PRSS:TPRS?....413

**[:SOURce<hw>]:BB:EUTRa:DL:CONF:MODE** <Scheduling>

Determines whether the configuration and scheduling of the different PDSCH allocations inside of the DL allocation table is performed manually or according to the configuration made for the DCIs.

**Parameters:**

<Scheduling> MANual | AUTO

**MANual**
No cross-reference between the settings made for the PDCCH DCIs and the PDSCHs settings. Configure the PDSCH allocations manually.

**AUTO**
Precoding for spatial multiplexing according to 3GPP TS 36.211 and the selected parameters.

*RST: MANual

**Example:** `BB:EUTR:DL:CONF:MODE AUTO`
enables the generation of 3GPP compliant EUTRA/LTE signal and the PDSCH allocations are configured automatically according to the configuration of the PDCCH DCIs.

**Manual operation:** See "PDSCH Scheduling" on page 131

---

**[:SOURce<hw>]:BB:EUTRa:DL:MIMO:CONFiguration** <Configuration>

Sets the global MIMO configuration.

**Parameters:**

<Configuration> TX1 | TX2 | TX4 | SIBF

*RST: TX1

**Example:** `BB:EUTR:DL:MIMO:CONF TX2`
sets the MIMO configuration to 2 TxAntennas.

**Manual operation:** See "Global MIMO Configuration" on page 145

---

**[:SOURce<hw>]:BB:EUTRa:DL:MIMO:ANTenna** <Antenna>

Queries the simulated antenna.

This command is allowed for simulation mode set to 1 Tx Antenna only.

**Parameters:**

<Antenna> ANT1 | ANT2 | ANT3 | ANT4

*RST: ANT1

**Example:** `BB:EUTR:DL:MIMO:CONF TX1`
sets 1 TxAntenna simulation mode.
`BB:EUTR:DL:MIMO:ANT?`
queries the simulated antenna.
`Response: ANT1`

**Manual operation:** See "Simulated Antenna" on page 145

**[:SOURce<hw>]:BB:EUTRa:DL:MIMO:ANTA** <AntennaA>

Sets the simulated antenna for path A. The available selections depend on the current MIMO configuration.

**Parameters:**

<AntennaA> ANT1 | ANT2 | ANT3 | ANT4 | NONE | ALL

*RST: ANT1

**Example:** `BB:EUTR:DL:MIMO:CONF TX2`
sets the MIMO configuration to 2 TxAntennas.
`BB:EUTR:DL:MIMO:ANTA ANT2`
sets the configuration to antenna 2.

**[:SOURce<hw>]:BB:EUTRa:DL:MIMO:ANTB** <AntennaB>

Sets the simulated antenna for path B. The available selections depend on the current MIMO configuration.

**Parameters:**

<AntennaB> NONE | ANT1 | ANT2 | ANT3 | ANT4

*RST: NONE

**Example:** `BB:EUTR:DL:MIMO:CONF TX4`
sets the MIMO configuration to 2 TxAntennas.
`BB:EUTR:DL:MIMO:ANTB ANT3`
sets the configuration to antenna 3.

**[:SOURce<hw>]:BB:EUTRa:DL:MIMO:APM:CS:AP<dir0>:BB<st0>:REAL** <AntPortMapDat>
**[:SOURce<hw>]:BB:EUTRa:DL:MIMO:APM:CS:AP<dir0>:BB<st0>:IMAGinary** <AntPortMapDat>

These commands define the mapping of the antenna ports to the physical antennas/ basebands.

**Suffix:**

<dir0> 0 | 1 | 2 | 3 | 4 | 6 | 15 | .. 22
antenna port
The mapping of `AP0` to `AP3` to the `BB1` to `BB4` is fixed.

<st0> 1 to 4
available basebands

**Parameters:**

<AntPortMapDat> float

Range: -1 to 1
Increment: 0.01
*RST: 0

**Options:** R&S SMW-K84

**Manual operation:** See "Cell Specific Antenna Port Mapping" on page 200

**[:SOURce<hw>]:BB:EUTRa:DL:MIMO:APM:MAPCoordinates** <Type>

Switches between the Cartesian (Real/Imag.) and Cylindrical (Magn./Phase) coordinates representation.

**Parameters:**

<Type> CARTesian | CYLindrical

*RST: CART

**Options:** R&S SMW-K84

**Manual operation:** See "Cell Specific Antenna Port Mapping" on page 200

**[:SOURce<hw>]:BB:EUTRa:DL:REFSig:POWer** <Power>

Sets the reference signal power.

**Parameters:**

<Power> float

Range: -80.00 dB to 10.00 dB
Increment: 0.001 dB
*RST: 0.00 dB

**Example:** `BB:EUTR:DL:REFS:POW -10.00`
sets the reference signal power to -10.00dB.

**Manual operation:** See "Reference Signal Power" on page 137

**[:SOURce<hw>]:BB:EUTRa:DL:REFSig:EPRE** <RelToLevelDispl>

Queries the RS Power per RE relative to Level Display.

**Parameters:**

<RelToLevelDispl> float

Range: -80.00 dB to 10.00 dB
Increment: 0.001 dB
*RST: 0.00 dB

**Example:** `BB:EUTR:DL:REFS:EPRE?`
queries the RS Power per RE relative to Level Display.

**Manual operation:** See "RS Power per RE relative to Level Display" on page 137

**[:SOURce<hw>]:BB:EUTRa:DL:SYNC:TXANtenna** <TxAntenna>

Defines on which antenna port the P-/S-SYNC is transmitted.

The available values depend on the number of configured antennas.

**Parameters:**

<TxAntenna> ANT1 | ANT2 | ANT3 | ANT4 | NONE | ALL

*RST: ALL

**Example:** `BB:EUTR:DL:SYNC:TXAN ALL`
enables all antenna ports to transmit P-/S-SYNC

**Manual operation:** See "P-/S-SYNC Tx Antenna" on page 137

---

**[:SOURce<hw>]:BB:EUTRa:DL:SYNC:PPOWer** <PPower>

Sets the power of the primary synchronization signal (P-SYNC).

**Parameters:**
<PPower> float

Range: -80.00 dB to 10.00 dB
Increment: 0.001 dB
*RST: 0 dB

**Example:** `BB:EUTR:DL:SYNC:PPOWer -10.00`
sets the P-SYNC power to -10.00dB.

**Manual operation:** See "P-SYNC Power" on page 137

---

**[:SOURce<hw>]:BB:EUTRa:DL:SYNC:SPOWer** <SPower>

Sets the power of the secondary synchronization signal (S-SYNC).

**Parameters:**
<SPower> float

Range: -80.00 dB to 10.00 dB
Increment: 0.001 dB
*RST: 0 dB

**Example:** `BB:EUTR:DL:SYNC:SPOWer -10.00`
sets the S-SYNC power to -10.00dB.

**Manual operation:** See "S-SYNC Power" on page 137

---

**[:SOURce<hw>]:BB:EUTRa:DL:BW** <Bw>

Sets the DL channel bandwidth.

**Parameters:**
<Bw> USER | BW1_40 | BW3_00 | BW5_00 | BW10_00 | BW15_00 | BW20_00

*RST: BW10_00

**Example:** `BB:EUTR:DL:BW BW20_00`

**Manual operation:** See "Channel Bandwidth" on page 128

---

**[:SOURce<hw>]:BB:EUTRa:DL:NORB** <Norb>

Selects the number of physical resource blocks per slot.

**Parameters:**

<Norb> integer

Range: 6 to 110
Increment: 1
*RST: 50

**Example:** `BB:EUTR:DL:BW USER`
sets the bandwidth mode to USER in downlink.
`BB:EUTR:DL:NORB 7`
sets the number of resource blocks to 7.

**Manual operation:** See "Number of Resource Blocks Per Slot" on page 129

---

**[:SOURce<hw>]:BB:EUTRa:DL:SRATe?**

Queries the sampling rate. The value for the sampling rate is set automatically according to the selected number of resource blocks per slot.

**Return values:**

<SampleRate> float

Range: 1.92 MHz to 30.72 MHz
Increment: 0.001 MHz
*RST: 15.36 MHz

**Example:** `BB:EUTR:DL:SRAT?`
queries the automatically set sampling rate.

**Usage:** Query only

**Manual operation:** See "Sampling Rate" on page 130

---

**[:SOURce<hw>]:BB:EUTRa:DL:FFT** <Fft>

Sets the FFT (Fast Fourier Transformation) size. The available values depend on the selected number of resource blocks per slot.

**Parameters:**

<Fft> integer

Range: 128 to 2048
*RST: 1024

**Example:** `BB:EUTR:DL:FFT?`
Queries the automatically set fast Fourier transformation parameter.

**Manual operation:** See "FFT Size" on page 129

---

**[:SOURce<hw>]:BB:EUTRa:DL:OCCBandwidth?**

Queries the of occupied bandwidth. This value is set automatically according to the selected number of resource blocks per slot.

**Return values:**
<OccupBandwidth> float
Range: 1.095 MHz to 19.815 MHz
*RST: 9.015 MHz

**Example:** `BB:EUTR:DL:OCCB?`
queries the automatically set occupied bandwidth in downlink.

**Usage:** Query only

**Manual operation:** See "Occupied Bandwidth" on page 130

---

**[:SOURce<hw>]:BB:EUTRa:DL:OCCSubcarriers?**

Queries the occupied subcarriers. The value is set automatically according to the selected number of physical resource blocks.

**Return values:**
<OccupSubcarr> integer
Range: 72 to 1321
*RST: 601

**Example:** `BB:EUTR:DL:OCCS?`
queries the number of occupied subcarriers.

**Usage:** Query only

**Manual operation:** See "Number Of Occupied Subcarriers" on page 130

---

**[:SOURce<hw>]:BB:EUTRa:DL:LGS?**

Queries the number of left guard subcarriers. The value is set automatically according to the selected number of physical resource blocks.

**Return values:**
<Lgs> integer
Range: 28 to 364
*RST: 212

**Example:** `BB:EUTR:DL:LGS?`
queries the number of left guard subcarriers.

**Usage:** Query only

**Manual operation:** See "Number Of Left Guard Subcarriers" on page 130

---

**[:SOURce<hw>]:BB:EUTRa:DL:RGS?**

Queries the number of right guard subcarriers. The value is set automatically according to the selected channel bandwidth and the number of physical resource blocks.

**Return values:**

<Rgs> integer

Range: 27 to 364
*RST: 211

**Example:** `BB:EUTR:DL:RGS?`
queries the number of right guard subcarriers.

**Usage:** Query only

**Manual operation:** See "Number Of Right Guard Subcarriers" on page 130

---

**[:SOURce<hw>]:BB:EUTRa:DL[:PLCi]:CID** <CellId>

Sets the cell identity.

There are 504 unique physical layer cell identities (Cell ID), grouped into 168 unique physical cell identity groups that contain three unique identities each. The Cell ID is calculated as following:

Cell ID = 3*Physical Cell ID Group + Physical Layer ID,

where Physical Cell ID Group is set with the command `[:SOURce<hw>]:BB:EUTRa:DL[:PLCi]:CIDGroup` and Physical Layer ID with the command `[:SOURce<hw>]:BB:EUTRa:DL[:PLCi]:PLID` respectively.

**Parameters:**

<CellId> float

Range: 0 to 503
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:PLC:CID 100`
sets the Cell ID.

**Manual operation:** See "Cell ID" on page 132

---

**[:SOURce<hw>]:BB:EUTRa:DL[:PLCi]:CIDGroup** <CellIdGroup>

Sets the ID of the physical cell identity group.

There are 504 unique physical layer cell identities, grouped into 168 uniquie physical cell identity groups that contain three unique identities each.

To configure these identities, use the command `[:SOURce<hw>]:BB:EUTRa:DL[:PLCi]:PLID`.

**Parameters:**

<CellIdGroup> integer

Range: 0 to 167
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:PLC:CIDG 100`
sets the ID of the physical cell identity group.

**Manual operation:** See "Physical Cell ID Group" on page 132

---

**[:SOURce<hw>]:BB:EUTRa:DL[:PLCi]:PLID** <PhysLayId>

Sets the identity of the physical layer within the selected physical cell identity group, set with the command `[:SOURce<hw>]:BB:EUTRa:DL[:PLCi]:CIDGroup`.

**Parameters:**
<PhysLayId> integer

Range: 0 to 2
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:PLC:PLID 2`
sets the identity of the physical layer.

**Manual operation:** See "Physical Layer ID" on page 133

---

**[:SOURce<hw>]:BB:EUTRa:DL:CSETtings:RARNti** <RaRnti>

Sets the random-access response identity RA-RNTI.

The value selected here determines the value of the parameter "UE_ID/n_RNTI" in case a RA_RNTI "User" is selected.

**Parameters:**
<RaRnti> integer

Range: 1 to 60
Increment: 1
*RST: 1

**Example:** `BB:EUTR:DL:PLC:CSET:RARN 5`
sets the RA-RNTI

**Manual operation:** See "RA_RNTI" on page 135

---

**[:SOURce<hw>]:BB:EUTRa:DL:CPC** <CyclicPrefix>

Sets the cyclic prefix length for all subframes.

**Parameters:**
<CyclicPrefix> NORMal | EXTended | USER

*RST: NORM

**Example:** `BB:EUTR:DL:CPC NORM`
a normal prefix is used in all subframes in downlink.
`BB:EUTR:DL:CPC USER`
the cyclic prefix has to be adjusted on subframe basis.
`BB:EUTR:DL:SUBF6:CYCP NORM`
a normal prefix is used in subframe 6 in downlink.
`BB:EUTR:DL:SUBF1:CYCP EXT`
an extended prefix is used in subframe 1 in downlink.

**Manual operation:** See "Cyclic Prefix (General DL Settings)" on page 133

---

**[:SOURce<hw>]:BB:EUTRa:DL:ULCPc** <GSCpcOppDir>

In TDD duplexing mode, sets the cyclic prefix for the opposite direction.

**Parameters:**
<GSCpcOppDir> NORMal | EXTended
*RST: NORM

**Example:**
```
:SOURce1:BB:EUTRa:DUPLexing TDD
:SOURce1:BB:EUTRa:DL:ULCPc EXTended
```

**Manual operation:** See "UL/DL Cyclic Prefix" on page 133

---

**[:SOURce<hw>]:BB:EUTRa:DL:PBCH:RATBa** <RatioPbPa>

Sets the transmit energy ratio among the resource elements allocated for PBCH in the OFDM symbols containing reference signal (P_B) and such not containing one (P_A).

**Parameters:**
<RatioPbPa> float
Range: -10.00 to 10.00
Increment: 0.001
*RST: 0
Default unit: dB

**Example:** `BB:EUTR:DL:PBCH:RATB -5.0`
sets the transmit energie ratio

**Manual operation:** See "PBCH Ratio rho_B/rho_A" on page 134

---

**[:SOURce<hw>]:BB:EUTRa:DL:PDCCh:RATBa** <RatioPbBa>

Sets the transmit energy ratio among the resource elements allocated for PDCCH in the OFDM symbols containing reference signal (P_B) and such not containing one (P_A).

**Parameters:**
<RatioPbBa> float
Range: -10.00 dB to 10.00 dB
Increment: 0.001
*RST: 0 dB

**Example:** `BB:EUTR:DL:PDCC:RATB -5.0`
sets the transmit energie ratio

**Manual operation:** See "PDCCH Ratio rho_B/rho_A" on page 134

---

**[:SOURce<hw>]:BB:EUTRa:DL:PDSCh:PB** <Pb>

Sets the parameter PDSCH P_B and defines the cell-specific ratio rho_B/rho_A according to 3GPP TS 36.213, Table 5.2-1.

**Parameters:**

<Pb> integer

Range: 0 to 3
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:PDSC:PB 1`
sets the parameter PDSCH P_B

**Manual operation:** See "PDSCH P_B" on page 133

---

**[:SOURce<hw>]:BB:EUTRa:DL:PDSCh:RATBa** <RatioPbPa>

Sets the transmit energy ratio among the resource elements allocated for PDSCH in the OFDM symbols containing reference signal (P_B) and such not containing one (P_A).

**Parameters:**

<RatioPbPa> float

Range: -10.00 dB to 10.00 dB
Increment: 0.001
*RST: 0 dB

**Example:** `BB:EUTR:DL:PDSC:RATB -5.0`
sets the transmit energie ratio

**Manual operation:** See "PDSCH Ratio rho_B/rho_A" on page 134

---

**[:SOURce<hw>]:BB:EUTRa:DL:PHICh:DURation** <Duration>

Sets the PHICH duration, i.e. the allocation of the PHICH resource element groups over the OFDM symbols.

The value selected puts the lower limit of the size of the Control Region for PUCCH ( `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PCFich:CREGion`) that is signaled by the PCFICH.

**Parameters:**

<Duration> NORMal | EXTended

**NORMal**
All ressource element groups of PHICH ([:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh:NOGRoups) are allocated on the first OFDM symbol (OFDM Symbol 0).

**EXTended**
The ressource element groups of PHICH are distributed over three OFDM symbol (OFDM Symbols 0 .. 2).

*RST: NORMal

**Example:** BB:EUTR:DL:PHIC:DUR NORM
sets PHICH normal duration

**Manual operation:** See "PHICH Duration" on page 134

---

**[:SOURce<hw>]:BB:EUTRa:DL:PHICh:NGParameter** <NgParameter>

Sets the parameter N_g according to 3GPP TS 36.211, section 6.9 or enables the selection of user-defined value for the parameter "Number of PHICH Groups" (command [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh:NOGRoups on page 468).

**Parameters:**

<NgParameter> NG1_6 | NG1_2 | NG1 | NG2 | NGCustom

**NG1_6 | NG1_2 | NG1 | NG2**
the actual "Number of PHICH Groups" for the different subframes is calculated according to 3GPP TS 36.211, section 6.9.

**NGCustom**
enables the selection of user-defined value for the parameter "Number of PHICH Groups".

*RST: NG1_6

**Example:** BB:EUTR:DL:PHIC:NGP NG1_2
sets PHICH N_g

**Manual operation:** See "PHICH N_g" on page 134

---

**[:SOURce<hw>]:BB:EUTRa:DL:PRSS:BW** <PrsBandwidth>

Defines the bandwidth in which the PRS is transmitted.

**Parameters:**

<PrsBandwidth> BW1_40 | BW3_00 | BW5_00 | BW10_00 | BW15_00 | BW20_00

*RST: BW10_00

**Example:** BB:EUTR:DL:PRSS:BW BW1_40
Sets the bandwidth in which the PRS is transmitted to 1.4 MHz.

**Options:** R&S SMW-K84

**Manual operation:** See "PRS Bandwidth" on page 140

---

**[:SOURce<hw>]:BB:EUTRa:DL:PRSS:CI** <ConfIdx>

Sets the PRS Configuration Index $I_{PRS}$ as defined in 3GPP TS 36.211, table 6.10.4.3-1.

**Parameters:**

<ConfIdx> integer

Range: 0 to 2399
Increment: 1
*RST: 0

**Options:** R&S SMW-K84

**Manual operation:** See "PRS Configuration Index" on page 139

---

**[:SOURce<hw>]:BB:EUTRa:DL:PRSS:DPRS?**

Queries the subframe offset of the PRS generation ($Delta_{PRS}$) as defined in 3GPP TS 36.211, table 6.10.4.3-1.

**Return values:**

<DeltaPRS> integer

Range: 0 to 1279
Increment: 1
*RST: 0

**Usage:** Query only

**Options:** R&S SMW-K84

**Manual operation:** See "PRS Subframe offset Delta_PRS" on page 140

---

**[:SOURce<hw>]:BB:EUTRa:DL:PRSS:NPRS** <NumberPRS>

Defines the number of consecutive DL subframes in that PRS are transmitted.

**Parameters:**

<NumberPRS> integer

Range: 1 to 6
*RST: 1

**Options:** R&S SMW-K84

**Manual operation:** See "Number of PRS DL Subframes (N_PRS)" on page 140

---

**[:SOURce<hw>]:BB:EUTRa:DL:PRSS:POW** <PrsPower>

Sets the power of a PRS resource element relative to the power of a common reference signal resource element.

**Parameters:**

<PrsPower> float

Range: -80.000 to 10.000
Increment: 0.001
*RST: 0

**Options:** R&S SMW-K84

**Manual operation:** See "PRS Power" on page 140

---

**[:SOURce<hw>]:BB:EUTRa:DL:PRSS:STATe** <PrsState>

Enables the generation of the PRS.

**Parameters:**

<PrsState> 0 | 1 | OFF | ON

*RST: OFF

**Options:** R&S SMW-K84

**Manual operation:** See "PRS State" on page 139

---

**[:SOURce<hw>]:BB:EUTRa:DL:PRSS:TPRS?** <PeriodicityTPRS>

Queries the periodicity of the PRS generation ($T_{PRS}$) as defined in 3GPP TS 36.211, table 6.10.4.3-1.

**Parameters:**

<PeriodicityTPRS> integer

Range: 160 to 1280
*RST: 160

**Usage:** Query only

**Options:** R&S SMW-K84

**Manual operation:** See "PRS Periodicity T_PRS" on page 139

## 9.9 General EUTRA/LTE Uplink Settings

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**[:SOURce<hw>]:BB:EUTRa:UL:BW** <BandWidth>

Sets the UL channel bandwidth.

**Parameters:**

<BandWidth> USER | BW1_40 | BW3_00 | BW5_00 | BW10_00 | BW15_00 | BW20_00

*RST: BW10_00

**Example:** `BB:EUTR:UL:BW BW1_40`
selects a uplink frequency band of 1.4 MHz.

**Manual operation:** See "Channel Bandwidth (UL)" on page 202

**[:SOURce<hw>]:BB:EUTRa:UL:NORB** <NumResBlocks>

Selects the number of physical resource blocks per slot.

**Parameters:**

<NumResBlocks> integer

Range: 6 to 110
Increment: 1
*RST: 50

**Example:** `BB:EUTR:UL:BW USER`
sets the bandwidth mode to USER in downlink.
`BB:EUTR:UL:NORB 7`
sets the number of resource blocks to 7.

**Manual operation:** See "Number of Resource Blocks Per Slot (UL)" on page 203

---

**[:SOURce<hw>]:BB:EUTRa:UL:SRATe** <SampRate>

Queries the sampling rate. The value for the sampling rate is set automatically according to the selected number of resource blocks per slot.

**Parameters:**
<SampRate> float
Range: 1.92 MHz to 30.72 MHz
Increment: 0.001 MHz
*RST: 15.36 MHz

**Example:** `BB:EUTR:UL:SRAT?`
queries the automatically set sampling rate.

**Manual operation:** See "Sampling Rate (UL)" on page 204

---

**[:SOURce<hw>]:BB:EUTRa:UL:FFT** <FftSize>

Sets the FFT (Fast Fourier Transformation) size. The available values depend on the selected number of resource blocks per slot.

**Parameters:**
<FftSize> integer
Range: 128 to 2048
*RST: 1024

**Example:** `BB:EUTR:UL:FFT?`
queries the automatically set FFT size.

**Manual operation:** See "FFT Size (UL)" on page 203

---

**[:SOURce<hw>]:BB:EUTRa:UL:OCCBandwidth?**

Queries the occupied bandwidth. This value is set automatically according to the selected number of resource blocks per slot.

**Return values:**
<OccBandwidth> float
Range: 1.080 to 19.800
*RST: 9.000
Default unit: MHz

**Example:** `BB:EUTR:UL:OCCB?`
queries the automatically set occupied bandwidth in uplink.

**Usage:** Query only

**Manual operation:** See "Occupied Bandwidth (UL)" on page 204

---

**[:SOURce<hw>]:BB:EUTRa:UL:OCCSubcarriers?**

Queries the occupied subcarriers. The value is set automatically according to the selected number of resource blocks per slot.

**Return values:**
<OccSubcarriers> integer

Range: 72 to 1320
*RST: 600

**Example:** `BB:EUTR:UL:OCCS?`
queries the number of occupied subcarriers.

**Usage:** Query only

**Manual operation:** See "Number Of Occupied Subcarriers (UL)" on page 204

---

**[:SOURce<hw>]:BB:EUTRa:UL:LGS?**

Queries the number of left guard subcarriers. The value is set automatically according to the selected number of resource blocks per slot.

**Return values:**
<LgSubCarr> integer

Range: 28 to 364
*RST: 212

**Example:** `BB:EUTR:UL:LGS?`
queries the number of left guard subcarriers.

**Usage:** Query only

**Manual operation:** See "Number Of Left Guard Subcarriers (UL)" on page 204

---

**[:SOURce<hw>]:BB:EUTRa:UL:RGS?**

Queries the number of right guard subcarriers. The value is set automatically according to the selected number of resource blocks per slot.

**Return values:**
<RgSubCarr> integer

Range: 28 to 364
*RST: 212

**Example:** `BB:EUTR:UL:RGS?`
queries the number of right guard subcarriers.

**Usage:** Query only

**Manual operation:** See "Number Of Right Guard Subcarriers (UL)" on page 204

**[:SOURce<hw>]:BB:EUTRa:UL[:PLCi]:CID** <CellId>

Sets the cell identity.

There are 504 unique physical layer cell identities (Cell ID), grouped into 168 unique physical cell identity groups that contain three unique identities each. The Cell ID is calculated as following:

Cell ID = 3*Physical Cell ID Group + Physical Layer ID,

where Physical Cell ID Group is set with the command `[:SOURce<hw>]:BB:EUTRa:UL[:PLCi]:CIDGroup` and Physical Layer ID with the command `[:SOURce<hw>]:BB:EUTRa:UL[:PLCi]:PLID`respectively.

**Parameters:**

<CellId> integer

Range: 0 to 503
Increment: 1
*RST: 0

**Example:** `BB:EUTR:UL:PLC:CID 100`
sets the Cell ID.

**Manual operation:** See "Cell ID (UL)" on page 205

**[:SOURce<hw>]:BB:EUTRa:UL[:PLCi]:CIDGroup** <PhysCellIdGroup>

Sets the ID of the physical cell identity group.

**Parameters:**

<PhysCellIdGroup> integer

Range: 0 to 167
Increment: 1
*RST: 0

**Example:** `BB:EUTR:UL:PLC:CIDG 100`
sets the UL physical cell ID group

**Manual operation:** See "Physical Cell ID Group (UL)" on page 205

**[:SOURce<hw>]:BB:EUTRa:UL[:PLCi]:PLID** <PhysicalLayerId>

Sets the identity of the physical layer within the selected physical cell identity group, set with the command `[:SOURce<hw>]:BB:EUTRa:UL[:PLCi]:CIDGroup`.

**Parameters:**

<PhysicalLayerId> integer

Range: 0 to 2
Increment: 1
*RST: 0

**Example:** `BB:EUTR:UL:PLC:PLID 2`
sets the UL physical layer ID

**Manual operation:** See "Physical Layer ID (UL)" on page 206

**[:SOURce<hw>]:BB:EUTRa:UL:CPC** <CyclicPrefix>

Sets the cyclic prefix length for all subframes.

**Parameters:**
<CyclicPrefix> NORMal | EXTended | USER
*RST: NORM

**Example:** `BB:EUTR:UL:CPC NORM`
a normal prefix is used in all subframes in uplink.

**Example:** `BB:EUTR:UL:CPC USER`
the cyclic prefix has to be adjusted on subframe basis.
`BB:EUTR:UL:SUBF6:CYCP NORM`
a normal prefix is used in subframe 6 in uplink.
`BB:EUTR:UL:SUBF1:CYCP EXT`
an extended prefix is used in subframe 1 in uplink.

**Manual operation:** See "Cyclic Prefix (General UL Settings)" on page 206

**[:SOURce<hw>]:BB:EUTRa:UL:DLCPc** <GSCpcOppDir>

In TDD mode, determines the cyclic prefix for the appropriate opposite direction.

**Parameters:**
<GSCpcOppDir> NORMal | EXTended
*RST: NORM

**Example:**
```
:SOURce1:BB:EUTRa:DUPLexing TDD
:SOURce1:BB:EUTRa:UL:DLCPc EXTended
```

**Manual operation:** See "UL/DL Cyclic Prefix" on page 133

**[:SOURce<hw>]:BB:EUTRa:UL:REFSig:GRPHopping** <GroupHopping>

Enables/disables group hopping for the uplink reference signals demodulation reference signal (DRS) and sounding reference signal (SRS).

**Parameters:**
<GroupHopping> 0 | 1 | OFF | ON
*RST: OFF

**Example:** `BB:EUTR:UL:REFS:GRPH ON`
enables group hopping

**Manual operation:** See "Group Hopping" on page 207

**[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SEQHopping** <SequenceHopping>

Enables/disables sequence hopping for the uplink reference signals demodulation reference signal (DRS) and sounding reference signal (SRS).

**Parameters:**

<SequenceHopping> 0 | 1 | OFF | ON

*RST: OFF

**Example:** `BB:EUTR:UL:REFS:SEQH ON`
enables sequence hopping

**Manual operation:** See "Sequence Hopping" on page 208

**[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DSSHift** <DeltaSeqShift>

Sets the delta sequence shift for PUSCH needed for the calculation of the group hopping pattern.

**Parameters:**

<DeltaSeqShift> integer

Range: 0 to 29
Increment: 1
*RST: 0

**Example:** `BB:EUTR:UL:REFS:DSSH 3`
sets the delta sequence shift for PUSCH

**Manual operation:** See "Delta Sequence Shift for PUSCH" on page 208

**[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DMRS** <DrsDmrs>

Sets the part of the demodulation reference signal (DMRS) index which is broadcasted and therefore valid for the whole cell. This index applies when multiple shifts within a cell are used and is used by the calculation of the DMRS sequence.

**Parameters:**

<DrsDmrs> integer

Range: 0 to 11
Increment: 1
*RST: 0

**Example:** `BB:EUTR:UL:REFS:DMRS 4`
sets the demodulation reference signal index to 4

**Manual operation:** See "n(1)_DMRS" on page 208

**[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:ANSTx** <AnSrsSimTxState>

Enables/disables simultaneous transmission of SRS (sounding reference signal) and ACK/NACK messages, i.e. transmission of SRS and PUCCH in the same subframe.

**Parameters:**
<AnSrsSimTxState> 0 | 1 | OFF | ON
*RST: OFF

**Example:** `BB:EUTR:UL:REFS:SRS:ANST ON`

**Manual operation:** See "A/N + SRS simultaneous Tx" on page 209

---

**[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:MUPTs** <MaxUpPts>

Enables/disables the cell specific parameter srsMaxUpPts.

If enabled, a SRS transmission in the UpPTS field (TDD) is made only in the frequency area that does not overlap with the frequency resources reserved for a possible PRACH preamble format 4 transmission.

This is done by reconfiguring the number of SRS resource blocks in the special subframes, which would otherwise be determined by C_SRS and B_SRS.

**Parameters:**
<MaxUpPts> 0 | 1 | OFF | ON
*RST: OFF

**Example:** `BB:EUTR:UL:REFS:SRS:MUPT ON`
enables the parameter srsMaxUpPts

**Manual operation:** See "SRS MaxUpPTS" on page 209

---

**[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:CSRS** <Csrs>

Sets the cell specific parameter SRS Bandwidth Configuration ($C_{SRS}$).

**Parameters:**
<Csrs> integer
Range: 0 to 7
Increment: 1
*RST: 0

**Example:** `BB:EUTR:UL:REFS:SRS:CSRS 4`
sets the SRS bandwidth configuration

**Manual operation:** See "SRS Bandwidth Configuration C_SRS" on page 209

---

**[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:DSFC?**

Queries the value for the cell specific parameter transmission offset $Delta_{SFC}$ in subframes, depending on the selected SRS Subframe Configuration (`[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:CSRS`)and the Duplexing mode (`[:SOURce<hw>]:BB:EUTRa:DUPLexing`).

**Return values:**
<DeltSFC> string

**Example:** `BB:EUTR:UL:REFS:SRS:SUC 4`
sets the SRS configuration
`BB:EUTR:UL:REFS:SRS:DSFC?`
queries the Delta_SFC parameter

**Usage:** Query only

**Manual operation:** See "Transmission Offset Delta_SFC" on page 209

---

**[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:SUConfiguration** <SubFrameConfig>

Sets the cell specific parameter SRS subframe configuration.

**Parameters:**
<SubFrameConfig> integer
Range: 0 to 15
Increment: 1
*RST: 0

**Example:** `BB:EUTR:UL:REFS:SRS:SUC 4`
sets the SRS configuration

**Manual operation:** See "SRS Subframe Configuration" on page 208

---

**[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:TSFC?**

Queries the value for the cell specific parameter configuration period $T_{SFC}$ in subframes, depending on the selected SRS Subframe Configuration (`[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:CSRS`)and the Duplexing mode (`[:SOURce<hw>]:BB:EUTRa:DUPLexing`).

**Return values:**
<Tsfc> string

**Example:** `BB:EUTR:UL:REFS:SRS:SUC 4`
sets the SRS configuration
`BB:EUTR:UL:REFS:SRS:TSFC?`
queries the T_SFC parameter

**Usage:** Query only

**Manual operation:** See "Configuration Period T_SFC" on page 209

---

**[:SOURce<hw>]:BB:EUTRa:UL:PRACh:CONFiguration** <Configuration>

Sets the PRACH configuration number as defined in the 3GPP TS 36.211, i.e. defines the time and frequency resources in which random access preamble transmission is allowed.

**Parameters:**

<Configuration> integer

Range: 0 to 63
Increment: 1
*RST: 0

**Example:** `BB:EUTR:UL:PRAC:CONF 10`
sets the PRACH configuration

**Manual operation:** See "PRACH Configuration" on page 210

---

**[:SOURce<hw>]:BB:EUTRa:UL:PRACh:FOFFset** <FrequencyOffset>

For preamble formats 0-3, sets the prach-FrequencyOffset $n^{RA}_{PRBoffset}$ as defined in the 3GPP TS 36.211, i.e. determines the first physical resource block available for PRACH expressed as a physical resource block number that fulfills the equation:

0 <= $n^{RA}_{PRBoffset}$ <= Number of UL Resource Blocks - 6

**Parameters:**

<FrequencyOffset> integer

Range: 0 to 104
Increment: 1
*RST: 0

**Example:** `BB:EUTR:UL:PRAC:FOFF 2`
sets the frequency offset

**Manual operation:** See "PRACH Frequency Offset" on page 210

---

**[:SOURce<hw>]:BB:EUTRa:UL:PRACh:RSET** <RestrictedSet>

Enables/disables using of a restricted preamble set.

**Parameters:**

<RestrictedSet> 0 | 1 | OFF | ON

*RST: ON

**Example:** `BB:EUTR:UL:PRAC:RSET ON`
enables using of restricted set

**Manual operation:** See "Restricted Set (High Speed Mode)" on page 211

---

**[:SOURce<hw>]:BB:EUTRa:UL:PUSCh:FHMode** <FreqHoppingMode>

Sets the frequency hopping mode for PUSCH.

Frequency hopping is applied according to 3GPP TS36.213.

**Parameters:**

<FreqHoppingMode> INTRa | INTer

**INTer**
An inter subframe hopping is performed.

**INTRa**
Both intra- and inter-subframe subframe hopping are performed.

*RST: INTRa

**Example:** `BB:EUTR:UL:PUSC:FHM INT`
selects inter subframe hopping mode

**Manual operation:** See "Frequency Hopping Mode" on page 212

---

**[:SOURce<hw>]:BB:EUTRa:UL:PUSCh:FHOFfset** <FHoppOffset>

Sets the PUSCH Hopping Offset $N_{RB}^{HO}$.

The PUSCH Hopping Offset determines the first physical resource block and the maximum number of physical resource blocks available for PUSCH transmission if PUSCH frequency hopping is used.

**Parameters:**

<FHoppOffset> integer

Range: 0 to max
Increment: 1
*RST: 0

**Example:** `BB:EUTR:UL:PUSC:FHOF 2`
set the PUSCH hopping offset

**Manual operation:** See "PUSCH Hopping Offset" on page 212

---

**[:SOURce<hw>]:BB:EUTRa:UL:PUSCh:NOSM** <SubBandCount>

Sets the number of sub-bands (Nsb) into that the total range of physical resource blocks available for PUSCH transmission is devided. The frequency hopping is performed at sub-band level.

**Parameters:**

<SubBandCount> integer

Range: 1 to 4
Increment: 1
*RST: 4

**Example:** `BB:EUTR:UL:PUSC:NOSM 3`
sets the number of sub-bands

**Manual operation:** See "Number of Sub-bands" on page 212

**[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:NORB** <RbCount>

Sets the PUCCH region in terms of reserved resource blocks, located at the edges of the channel bandwidth.

**Parameters:**

<RbCount> integer

Range: 0 to 110
Increment: 1
*RST: 4

**Example:** `BB:EUTR:UL:PUCC:NORB 3`
reserves 3 RBs for PUCCH

**Manual operation:** See "Number of RBs used for PUCCH" on page 213

**[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:DESHift** <DeltaShift>

Sets the delta shift parameter.

**Parameters:**

<DeltaShift> integer

Range: 1 to 3
Increment: 1
*RST: 2

**Example:** `BB:EUTR:PUCC:DESH 3`
sets the delta shift parameter

**Manual operation:** See "Delta Shift" on page 214

**[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N1CS** <N1Cs>

Sets the number of cyclic shifts used for PUCCH format 1/1a/1b in a resource block used for a combination of the formats 1/1a/1b and 2/2a/2b.

**Parameters:**

<N1Cs> integer

Range: 0 to 8
Increment: 1
*RST: 6

**Example:** `BB:EUTR:UL:PUCC:N1CS 5`
5 cyclic shifts will be used for PUCCH format 1/1a/1b in a RB used for a combination of the PUCCH formats 1/1a/1b and 2/2a/2b

**Manual operation:** See "N(1)_cs" on page 214

**[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N2RB** <N2Rb>

Sets bandwidth in terms of resource blocks that are reserved for PUCCH formats 2/2a/2b transmission in each subframe.

**Parameters:**

<N2Rb> integer

Range: 0 to 5
Increment: 1
*RST: 1

**Example:** `BB:EUTR:UL:PUCC:N2RB 3`
reserves 3 RB for PUCCH formats 2/2a/2b

**Manual operation:** See "N(2)_RB" on page 214

---

**[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N1NMax** <N1NormCP>

Queries the range of the possible PUCCH format 1/1a/1b transmissions from different users in one subframe and in case of normal CP.

**Parameters:**

<N1NormCP> integer

Range: 0 to 2639
Increment: 1
*RST: 44

**Example:** `BB:EUTR:UL:PUCC:N1NM?`
queries the range of the possible PUCCH formats 1/1a/1b transmissions.
`Response: 24`

**Manual operation:** See "Range n(1)_PUCCH (Normal CP)" on page 214

---

**[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N1EMax** <N1emax>

Queries the range of the possible PUCCH format 1/1a/1b transmissions from different users in one subframe and in case of extended CP.

**Parameters:**

<N1emax> integer

Range: 0 to 2639
Increment: 1
*RST: 29

**Example:** `BB:EUTR:UL:PUCC:N1EM?`
queries the range of the possible PUCCH formats 1/1a/1b transmissions.
`Response: 10`

**Manual operation:** See "Range n(1)_PUCCH (Extended CP)" on page 214

---

**[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N2Max** <N2Max>

Queries the range of possible number of PUCCH format 2/2a/2b transmissions from different users in one subframe.

**Parameters:**

<N2Max> integer

Range: 0 to 1319
Increment: 1
*RST: 15

**Example:** `BB:EUTR:UL:PUCC:N2M?`
queries the range of the possible PUCCH formats 2/2a/2b transmissions.
`Response: 16`

**Manual operation:** See "Range n(2)_PUCCH" on page 215

---

**[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N3Max** <N3Max>

Queries the range of possible number of PUCCH format 3 transmissions from different users in one subframe.

**Parameters:**

<N3Max> integer

Range: 0 to 549
Increment: 1
*RST: 19

**Manual operation:** See "Range n(3)_PUCCH" on page 215

## 9.10 DL Frame Configuration

**SUBF<st0>**

Defines the subframe number. Value range `<st0>`= 0 .. 39. The maximum value depends on the selected sequence length (see `[:SOURce<hw>]:BB:EUTRa:SLENgth` on page 372).

**ALLoc<ch0>**

Determines the allocation number.

Value range

- for subframes with PBCH, i.e. `SUBF0`, `SUBF10`, `SUBF20` and `SUBF30`:
  `<ch0>` = 0 .. 111
- for all other subframes:
  `<ch0>` = 0 .. 110

**CW<user>**

Determines the code word. Value range `<user>`= 1 | 2

[:SOURce<hw>]:BB:EUTRa:DL:VIEW:MODE....427
[:SOURce<hw>]:BB:EUTRa:DL:BUR....427
[:SOURce<hw>]:BB:EUTRa:DL:CONSubframes....428
[:SOURce<hw>]:BB:EUTRa:DL:RSTFrame....428

[:SOURce<hw>]:BB:EUTRa:DL:SFSelection....428
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:CYCPrefix....428
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALCount....429
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>:CODWords....429
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:MODulation....430
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:GAP....430
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:RBCount....431
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SYMCount....431
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:RBOFfset....432
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SYMoffset....432
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:AOC....433
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PHYSbits?....433
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:DATA....434
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PATTern....434
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:DSELect....434
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:POWer....435
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CONType....435
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:STATe....436
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CONFlict....436
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:TXM....436
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:UEC....437
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:USER<ch>:PHYSbits?....437

**[:SOURce<hw>]:BB:EUTRa:DL:VIEW:MODE** <Mode>

Determines whether the time plan shows the allocated Virtual Resource Blocks (VRBs) or the Physical Resource Blocks (PRBs).

**Parameters:**

<Mode> PRB | VRB

*RST: PRB

**Manual operation:** See "View Mode" on page 153

**[:SOURce<hw>]:BB:EUTRa:DL:BUR** <Bur>

Selects either to fill unscheduled resource elements and subframes with dummy data or DTX.

**Parameters:**

<Bur> DUData | DTX

*RST: DUData

**Example:** `BB:EUTR:DL:BUR DUD`
the unscheduled resource elements are filled with dummy data.

**Manual operation:** See "Behavior In Unscheduled REs (OCNG)" on page 147

**[:SOURce<hw>]:BB:EUTRa:DL:CONSubframes** <ConSubFrames>

Sets the number of configurable subframes. All downlink/special subframes are filled periodically with the configured subframes with the exception of the SYNC signals which are set globally in the "General Settings" menu and the PBCH channel, which can only be configured in subframe 0.

**Parameters:**

<ConSubFrames> integer

Range: 1 to 40
Increment: 1
*RST: 10

**Example:** `BB:EUTR:DL:CONS 10`
ten subframes are configurable in downlink.

**Manual operation:** See "No Of Configurable (DL) Subframes" on page 147

**[:SOURce<hw>]:BB:EUTRa:DL:RSTFrame**

Resets all subframe settings of the selected link direction to the default values.

**Example:** `BB:EUTR:DL:RSTF`
resets the downlink subframe parameters of path A to the default settings.

**Manual operation:** See "Reset Subframe Configuration" on page 147

**[:SOURce<hw>]:BB:EUTRa:DL:SFSelection** <SubFrameSel>

Sets the subframes to be configured in the resource allocation table.

**Parameters:**

<SubFrameSel> integer

Range: 0 to 39
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:SFS 0`
displays subframe 0 in the allocation list view.

**Manual operation:** See "Subframe Selection" on page 153

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:CYCPrefix** <CycPrefix>

(enabled for `BB:EUTR:DL:CPC USER` only)

Sets the cyclic prefix for the according subframe.

**Parameters:**

<CycPrefix> NORMal | EXTended

*RST: NORMal

**Example:** `BB:EUTR:DL:CPC USER`
the cyclic prefix has to be adjusted on subframe basis.
`BB:EUTR:DL:SUBF6:CYCP NORM`
a normal prefix is used in subframe 6 in downlink.

**Manual operation:** See "Cyclic Prefix" on page 154

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALCount** <AllocCount>

Sets the number of scheduled allocations in the selected subframe. The maximum number of allocations that can be scheduled depends on the number of the selected resource blocks.

**Parameters:**

<AllocCount> integer

Range: 0 to 112
Increment: 1
*RST: 2 (SUBF0, SUBF10,SUBF20,SUBF30); 1(all other subframes)

**Example:** `BB:EUTR:DL:SUBF4:ALC 5`
five scheduled allocations are assigned to subframe four.

**Manual operation:** See "No. Of Used Allocations" on page 154

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>:CODWords** <CodeWords>

Sets the number of code word for an allocation.

Two ocde words are available for global MIMO configuration with two or more antennas.

**Parameters:**

<CodeWords> 1 | 2

Range: 1 to 2
Increment: 1
*RST: 1

**Example:** `BB:EUTR:DL:MIMO:CONF TX2`
sets the MIMO configuration to 2 TxAntennas.
`BB:EUTR:DL:SUBF4:ALL5:CODW?`
queries the number of code words used for allocation 5 in subframe 4.
`Response: 2`
two code words are used for allocation 5 in subframe 4.

**Example:** In case the data source for an allocation is set to User, changing this parameter will set also the parameter "Code Word" of all allocations, belonging to the same User in the corresponding subframe.

```
SOUR:BB:EUTR:DL:SUBF1:ALL5:CODW 2
SOUR:BB:EUTR:DL:SUBF1:ALL5:CW:DATA USER3
SOUR:BB:EUTR:DL:SUBF1:ALL7:CW:DATA USER3
SOUR:BB:EUTR:DL:SUBF1:ALL7:CODW?
Response: 2
```

**Manual operation:** See "Codeword" on page 155

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:**
**MODulation** <Modulation>

Selects the modulation scheme for the allocation.

**Parameters:**

<Modulation> QPSK | QAM16 | QAM64

*RST: QPSK

**Example:** `BB:EUTR:DL:SUBF4:ALL5:CW2:MOD QPSK`
selects QPSK as modulation scheme for the allocation.

**Example:** In case the data source for an allocation is set to User, changing this parameter will set also the parameter "Modulation" of all allocations, belonging to the same User in the corresponding subframe.

```
SOUR:BB:EUTR:DL:SUBF1:ALL5:CW2:MOD QPSK
SOUR:BB:EUTR:DL:SUBF1:ALL5:CW:DATA USER3
SOUR:BB:EUTR:DL:SUBF1:ALL7:CW:DATA USER3
SOUR:BB:EUTR:DL:SUBF1:ALL5:CW2:MOD?
Response: QPSK
```

**Manual operation:** See "Mod." on page 155

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:GAP**
<VrbGap>

Enables/disabless the utimization of distributed Virtual Resource Blocks (VBR) and determines whether the first or the second VRB gap is applied. The VRB-to-PRB mapping and the calculation of the VRB gap values are performed according to 3GPP TS 36.211.

**Parameters:**

<VrbGap> integer

**0**
A **localized distribution** is applied, i.e. the PDSCH mapping is performed on a direct VRB-to-PRB mapping.

**1**
Enables a **distributed** ressource block allocation. The first VRB gap is used.

**2**
Enabled for "Channel Bandwidths" grater than 50 RBs.
The mapping is based on the second (smaller) VRB gap.

Range: 0 to 2
Increment: 0
*RST: 0

**Example:**
```
SOUR:BB:EUTR:DL:BW BW10_00
SOUR:BB:EUTR:SUBF0:ALL2:GAP2
```

**Manual operation:** See "VRB Gap" on page 156

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:RBCount** <ResBlockCount>

Sets the size of the selected allocation in resource blocks (per slot).

For allocations with two code words, the number of resource blocks for the second code word is automatically set to the number of resource blocks set for CW#1.

**Parameters:**

<ResBlockCount> integer

Range: 0 to 110
Increment: 1
*RST: 1

**Example:**
```
BB:EUTR:DL:SUBF4:ALL5:CW:RBC 3
```
the size of allocation five for subframe 4 is set to three resource blocks.

**Manual operation:** See "No. RB (Resource Blocks)" on page 159

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SYMCount** <SymCount>

Sets the size of the selected allocation in OFDM symbols.

For content type PBCH, PDCCH and PDSCH, this value is set automatically.

For allocations with two code words, the number of symbols for the second code word is automatically set to number of symbols set for CW#1.

**Parameters:**

<SymCount> integer

Range: 1 to 14
Increment: 1
*RST: 6 (PBCH); 12 (PDSCH)

**Example:** `BB:EUTR:DL:SUBF4:ALL5:CW:CONT RSVD`
selects reserved as type for the selected allocation.
`BB:EUTR:DL:SUBF4:ALL5:CW:SYMC 6`
the size of allocation five for subframe 4 is set to six OFDM symbols.

**Example:** For FDD mode and content type PDSCH, this value is set automatically in a way that the allocation always fills the complete subframe with consideration of the symbol offset.
`SOUR:BB:EUTR:DL:SUBF1:CYCP NORM`
`SOUR:BB:EUTR:DL:SUBF2:ALL2:CW2:SYM 2`
`SOUR:BB:EUTR:DL:SUBF1:ALL2:CW2:SYMC 12`

**Manual operation:** See "No. Sym." on page 159

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:RBOFfset**
<ResBlockOffset>

Queries the start resource block of the selected allocation.

This parameter is only configurable for content type Reserved.

**Note:** If the Auto Offset Calculation mode is activated, this value is read only.

**Parameters:**

<ResBlockOffset> integer

Range: 0 to 109
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:SUBF4:ALL5:CW:CONT RSVD`
selects reserved as type for the selected allocation.
`BB:EUTR:DL:SUBF4:ALL5:CW:RBOF 6`
resource block six is the start resource block for allocation five in subframe four.

**Manual operation:** See "Offs RB" on page 160

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SYMoffset**
<SymOffset>

Sets the start OFDM symbol of the selected allocation.

The allowed values depend on the selected Content Type, Number of Symbols and Cyclic Prefix.

For allocations with two code words, the symbol offset for the second code word is automatically set to the symbol offset set for CW#1.

**Note:** If the Auto Offset Calculation mode is activated, this value is read only.

**Parameters:**

<SymOffset> integer

Range: 0 to 13
Increment: 1
*RST: 2(PDSCH)

**Example:** `BB:EUTR:DL:SUBF4:ALL5:CW:SYM 5`
OFDM symbol five is the start OFDM symbol for allocation five in subframe four.

**Manual operation:** See "Offs Sym." on page 160

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:AOC <Aoc>**

Sets whether automatic offset calculation is used or not.

**Parameters:**

<Aoc> 0 | 1 | OFF | ON

*RST: ON

**Example:** `BB:EUTR:DL:SUBF4:ALL5:CW:AOC ON`
activates the automatic offset calculation for the selected allocation.

**Manual operation:** See "Auto" on page 160

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]: PHYSbits?**

Queries the number of physical bits for the selected allocation. The value is set automatically according to the current allocation settings.

**Return values:**

<PhysicalBits> integer

Range: 0 to 105600
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:SUBF4:ALL5:CW:PHYS?`
queries the number of physical bits for allocation five in subframe four.

**Usage:** Query only

**Manual operation:** See "Phys. Bits" on page 161

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:DATA** <Data>

Sets the data source for the selected allocation.

For allocations with two code words, the data source for the second code word is automatically set to the data source set for CW#1.

**Parameters:**

<Data> USER1 | USER2 | USER3 | USER4 | PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATTern | DLISt | ZERO | ONE | MIB

**MIB**
for PBCH allocation only
Indicates that the PBCH transmits real MIB data (see also `[:SOURce<hw>]:BB:EUTRa:DL:PBCH:MIB` on page 454).

*RST: PN9

**Example:** `BB:EUTR:DL:SUBF4:ALL5:CW:DATA PN9`
PN9 is the data source for the selected allocation.

**Example:** PBCH
```
SOUR:BB:EUTR:DL:PBCH:MIB ON
SOUR:BB:EUTR:DL:SUBF0:ALL0:CW:DATA?
Response: MIB
```

**Manual operation:** See "Data Source" on page 161

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PATTern** <Pattern>

Selects the bit pattern for the `PATTern` selection. The maximum length is 64 bits.

For allocations with two code words, the data source for the second code word is automatically set to the data source set for CW#1.

**Parameters:**

<Pattern> <bit pattern>

*RST: #H0,1

**Example:**
```
BB:EUTR:DL:SUBF4:ALL5:CW:DATA PATT
BB:EUTR:DL:SUBF4:ALL5:CW:PATT #H3F,8
```
defines the bit pattern.

**Manual operation:** See "DList/Pattern" on page 161

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:DSELect** <DSelect>

Selects the data list for the DLISt data source selection.

The lists are stored as files with the fixed file extensions `*.dm_iqd` in a directory of the user's choice. The directory applicable to the following commands is defined with the command `MMEMory:CDIR`. To access the files in this directory, you only have to give the file name, without the path and the file extension.

For allocations with two code words, the data source for the second code word is automatically set to the data source set for CW#1.

**Parameters:**

<DSelect> string

**Example:** `BB:EUTR:DL:SUBF2:ALL5:CW:DATA DLISt`
selects the Data Lists data source.
`MMEM:CDIR '/var/user/temp/Lists'`
selects the directory for the data lists.
`BB:EUTR:DL:SUBF2:ALL5:CW:DSELect 'eutra_list1'`
selects file '`eutra_list1`' as the data source. This file must be in the directory `/var/user/temp/Lists` and have the file extension `*.dm_iqd`.

**Manual operation:** See "DList/Pattern" on page 161

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:POWer**
<Power>

Sets the power $P_{PDSCH}$ respectively $P_{PBCH}$ for the selected allocation. The power of the PDCCH allocation $P_{PDCCH}$ is read-only. The value is set with the command `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:POWer`.

For allocations with two code words, the power for the second code word is automatically set to the power set for CW#1.

**Parameters:**

<Power> float

Range: -80.00 dB to 10.00 dB
Increment: 0.001 dB
*RST: 0 dB

**Example:** $P_{PDSCH}$, $P_{PBCH}$
`SOUR:BB:EUTR:DL:SUBF1:ALL2:POW 10.00`

**Example:** $P_{PDCCH}$
`SOUR:BB:EUTR:DL:SUBF1:ENCC:PDCC:POW 2.00`
`SOUR:BB:EUTR:DL:SUBF1:ALL1:POW?`
`Response: 2`

**Manual operation:** See "Rho A" on page 161

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CONType**
<ConType>

Selects the type for the selected allocation.

PBCH can be configured in subframe 0 only.

**Parameters:**

<ConType> PDSCh | PBCH | PDCCh | RSVD | PMCH

*RST: PDSCh

**Example:** `BB:EUTR:DL:SUBF4:ALL5:CW:CONT PDSC`
selects PDSCH as type for the selected allocation.

**Options:** R&S SMW-K84

**Manual operation:** See "Content Type" on page 161

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:STATe** <State>

Sets the allocation state to active or inactive.

**Parameters:**

<State> 0 | 1 | OFF | ON

*RST: OFF

**Example:** `BB:EUTR:DL:SUBF4:ALL5:CW:STAT OFF`
deactivates the selected allocation.

**Manual operation:** See "State" on page 162

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CONFlict** <Conflict>

Indicates a conflict between two allocations.

**Parameters:**

<Conflict> 0 | 1 | OFF | ON

*RST: OFF

**Example:** `BB:EUTR:DL:SUBF4:ALL5:CW2:CONF?`
queries for the selected allocation whether there is a conflict with another allocation.

**Manual operation:** See "Conflict" on page 162

---

**[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:TXM** <TxMode>

(enabled for "Auto/DCI" scheduling mode)

Sets the transmission mode of the according user as defined in 3GPP TS 36.213, section 7.1.

**Parameters:**

<TxMode> USER | M1 | M2 | M3 | M4 | M5 | M6 | M7 | M8 | M9

*RST: USER

**Options:** R&S SMW-K84

**Manual operation:** See "Tx Mode" on page 150

**[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:UEC** <UECategory>

Sets the UE Category.

**Parameters:**

<UECategory> USER | C1 | C2 | C3 | C5 | C4
*RST: USER

**Manual operation:** See "UE Category" on page 150

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:USER<ch>:PHYSbits?**

Queries the size of the selected allocation in bits and considering the subcarriers that are used for other signals or channels with higher priority.

If a User 1...4 is selected for the "Data Source" in the allocation table for the corresponding allocation, the value of the parameter "Number of Physical Bits" is the sum of the "Physical Bits" of all single allocations that belong to the same user in the selected subframe.

**Return values:**

<PhysicalBits> integer
Range: 0 to 100000
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:SUBF1:USER3:PHYS?`
queries the number of phisycal bits

**Usage:** Query only

**Manual operation:** See "Number of Physical Bits (DL)" on page 195

## 9.11 DL MBFSN Settings

**`PMCH<ch0>`**

Defines the PM channel number. Value range `<ch0>`= 0 .. 15.

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:ID....438
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:AVAL?....438
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:DATA....439
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:DLISt....439
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:MCS....439
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:MODulation?....439
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:MPER....440
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:NOFFset....440
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:NPATtern....440
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:NRC....440
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:NSI....441

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:OFFS....441
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:PATTern....441
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:RPER....441
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:STATe....442
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:TBSize?....442
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:NIND....442
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:NMRL....442
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:MODE....443
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:MTCH:CSAP....443
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:MTCH:NPMChs....443
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:DATA....444
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:DLISt....444
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:MCS....444
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:PATTern....444
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:SPERiod....445
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:SASTart....445
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:SAENd....445
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:RHOA....445
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:SC:AMODe....445
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:SC:AOFFset....446
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:SC:APER....446
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:SC:AVAL....446
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:UEC....446

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:ID** <AreaID>

Defines the MBSFN area ID, parameter $N_{id}^{MBSFN}$.

**Parameters:**

<AreaID> integer

Range: 0 to 255
Increment: 1
*RST: 0

**Options:** R&S SMW-K84

**Manual operation:** See "Area Info (SIB Type 13)" on page 123

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:AVAL?** <AllocationValue>

Indicates the subframes of the radio frames indicated by the "MCCH repetition period" and the "MCCH offset", that may carry MCCH.

**Parameters:**

<AllocationValue> float

*RST: 0

**Usage:** Query only

**Options:** R&S SMW-K84

**Manual operation:** See "Area Info (SIB Type 13)" on page 123

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:DATA** <DataSource>

Sets the data source used for the MCCH.

**Parameters:**

<DataSource> PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATTern | DLISt | ZERO | ONE

*RST: PN9

**Options:** R&S SMW-K84

**Manual operation:** See "Area Info (SIB Type 13)" on page 123

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:DLISt** <DataList>

Sets the data list used as data source for MCCH.

**Parameters:**

<DataList> string

**Options:** R&S SMW-K84

**Manual operation:** See "Area Info (SIB Type 13)" on page 123

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:MCS** <MCS>

Defines the Modulation and Coding Scheme (MCS) applicable for the subframes indicated by the "MCCH Allocation value" and for the first subframe of each MCH scheduling period (which may contain the MCH scheduling information provided by MAC).

**Parameters:**

<MCS> MCS19 | MCS13 | MCS7 | MCS2

*RST: MCS2

**Options:** R&S SMW-K84

**Manual operation:** See "Area Info (SIB Type 13)" on page 123

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:MODulation?** <Modulation>

Queries the values as determined by the "MCCH MCS".

**Parameters:**

<Modulation> QPSK | QAM16 | QAM64

*RST: QPSK

**Usage:** Query only

**Options:** R&S SMW-K84

**Manual operation:** See "Area Info (SIB Type 13)" on page 123

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:MPER** <ModifPeriod>

Sets the MCCH Modification Period.

**Parameters:**
<ModifPeriod> MP512 | MP1024
*RST: MP512

**Options:** R&S SMW-K84

**Manual operation:** See "Area Info (SIB Type 13)" on page 123

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:NOFFset** <NotifOffset>

Defines, together with the `[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:NRC`, the radio frames in which the MCCH information change notification is scheduled.

**Parameters:**
<NotifOffset> integer
Range: 0 to 10
Increment: 1
*RST: 0

**Options:** R&S SMW-K84

**Manual operation:** See "Area Info (SIB Type 13)" on page 123

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:NPATtern** <NotifPattern>

Sets the pattern for the notification bits sent on PDCCH DCI format 1c.

**Parameters:**
<NotifPattern> integer
*RST: #H1,2

**Options:** R&S SMW-K84

**Manual operation:** See "Area Info (SIB Type 13)" on page 123

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:NRC** <NotifRepetCoeff>

Selects the current change notification repetition period common for all MCCHs that are configured.

**Parameters:**
<NotifRepetCoeff> NRC2 | NRC4
*RST: NRC2

**Options:** R&S SMW-K84

**Manual operation:** See "Area Info (SIB Type 13)" on page 123

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:NSI** <Index>

Defines the subframe used to transmit MCCH change notifications on PDCCH.

In FDD: Value 1, 2, 3, 4, 5 and 6 correspond with subframe #1, #2, #3, #6, #7 and #8 respectively

In TDD: Value 1, 2, 3, 4 and 5 correspond with subframe #3, #4, #7, #8 and #9respectively

**Parameters:**

<Index> integer

Range: 0 to 10
Increment: 1
*RST: 0

**Options:** R&S SMW-K84

**Manual operation:** See "Area Info (SIB Type 13)" on page 123

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:OFFS** <McchOffset>

Indicates, together with the `[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:RPER`, the radio frames in which MCCH is scheduled.

**Parameters:**

<McchOffset> integer

Range: 0 to 10
Increment: 1
*RST: 0

**Options:** R&S SMW-K84

**Manual operation:** See "Area Info (SIB Type 13)" on page 123

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:PATTern** <Pattern>

Sets the pattern used as data source for the MCCH.

**Parameters:**

<Pattern> integer

*RST: #H0,1

**Options:** R&S SMW-K84

**Manual operation:** See "Area Info (SIB Type 13)" on page 123

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:RPER** <RepetPeriod>

Defines the interval between transmissions of MCCH information in radio frames.

**Parameters:**

<RepetPeriod> RP64 | RP32 | RP128 | RP256

*RST: RP32

**Options:** R&S SMW-K84

**Manual operation:** See "Area Info (SIB Type 13)" on page 123

---

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:STATe** <McchState>

Enables/disables the MCCH.

**Parameters:**

<McchState> 0 | 1 | OFF | ON
*RST: OFF

**Options:** R&S SMW-K84

**Manual operation:** See "Area Info (SIB Type 13)" on page 123

---

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:TBSize?** <TB_Size>

Queries the values as determined by the "MCCH MCS".

**Parameters:**

<TB_Size> integer

**Usage:** Query only

**Options:** R&S SMW-K84

**Manual operation:** See "Area Info (SIB Type 13)" on page 123

---

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:NIND** <NotifIndicator>

Defines which PDCCH bit is used to notify the UE about change of the MCCH applicable for this MBSFN area.

**Parameters:**

<NotifIndicator> integer
Range: 0 to 7
Increment: 1
*RST: 0

**Options:** R&S SMW-K84

**Manual operation:** See "Area Info (SIB Type 13)" on page 123

---

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:NMRL** <RegionLength>

Defines how many symbols from the beginning of the subframe constitute the non-MBSFN region.

**Parameters:**

<RegionLength> integer

Range: 1 to 2
Increment: 1
*RST: 2

**Options:** R&S SMW-K84

**Manual operation:** See "Area Info (SIB Type 13)" on page 123

---

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:MODE** <MbsfnMode>

Enables the MBSFN transmission and selects a mixed MBSFN Mode, i.e. the available subframes are shared between MBSFN and regular LTE operation.

**Parameters:**

<MbsfnMode> OFF | MIXed

*RST: OFF

**Options:** R&S SMW-K84

**Manual operation:** See "MBSFN Mode" on page 121

---

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:MTCH:CSAP** <AllocPeriod>

Defines the period during which resources corresponding with field *commonSF-Alloc* are divided between the (P)MCH that are configured for this MBSFN area.

**Parameters:**

<AllocPeriod> AP4 | AP8 | AP16 | AP32 | AP64 | AP128 | AP256

*RST: AP4

**Options:** R&S SMW-K84

**Manual operation:** See "PMCH Structure" on page 126

---

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:MTCH:NPMChs** <NumOfPMCHs>

Defines the number of PMCHs in this MBSFN area.

**Parameters:**

<NumOfPMCHs> int

Range: 1 to 15
Increment: 1
*RST: 1

**Options:** R&S SMW-K84

**Manual operation:** See "PMCH Structure" on page 126

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:DATA** <DataSource>

Sets the data source for the selected PMCH/MTCH.

**Parameters:**

<DataSource> PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATTern | DLISt | ZERO | ONE

*RST: PN9

**Options:** R&S SMW-K84

**Manual operation:** See "PMCH Structure" on page 126

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:DLISt** <DataList>

Sets the data list of the data source for the selected PMCH/MTCH.

**Parameters:**

<DataList> string

**Options:** R&S SMW-K84

**Manual operation:** See "PMCH Structure" on page 126

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:MCS** <MCS>

Defines the value for parameter according to [5] Table 7.1.7.1-1, which defines the Modulation and Coding Scheme (MCS) applicable for the subframes of this (P)MCH as indicated by the field *commonSF-Alloc*.

**Parameters:**

<MCS> integer

Range: 0 to 28
Increment: 1
*RST: 2

**Options:** R&S SMW-K84

**Manual operation:** See "PMCH Structure" on page 126

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:PATTern** <Pattern>

Sets the pattern of the data source for the selected PMCH/MTCH.

**Parameters:**

<Pattern> integer

*RST: #H0,1

**Options:** R&S SMW-K84

**Manual operation:** See "PMCH Structure" on page 126

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:SPERiod** <SchedPeriod>

Defines the MCH scheduling period, i.e. the periodicity used for providing MCH scheduling information at lower layers (MAC) applicable for an MCH.

**Parameters:**

<SchedPeriod> SPM | SPRF8 | SPRF16 | SPRF32 | SPRF64 | SPRF128 | SPRF256 | SPRF512 | SPRF1024

*RST: SPM

**Options:** R&S SMW-K84

**Manual operation:** See "PMCH Structure" on page 126

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:SASTart** <AllocStart>
**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:SAENd** <AllocEnd>

Defines the first/last subframe allocated to this (P)MCH within a period identified by field *commonSF-Alloc*.

**Parameters:**

<AllocEnd> integer

Range: 0 to 1535
Increment: 1
*RST: 0

**Options:** R&S SMW-K84

**Manual operation:** See "PMCH Structure" on page 126

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:RHOA** <RhoA>

Defines the power of the MBSFN channels relative to the common Reference Signals.

**Parameters:**

<RhoA> float

Range: -80.000 to 10.000
Increment: 0.001
*RST: 0

**Options:** R&S SMW-K84

**Manual operation:** See "MBSFN Rho A" on page 121

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:SC:AMODe** <AllocationMode>

Defines whether MBSFN periodic scheduling is 1 or 4 frames.

**Parameters:**

<AllocationMode> F1 | F4

*RST: F1

**Options:** R&S SMW-K84

**Manual operation:** See "Subframe Config (SIB Type 2)" on page 122

---

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:SC:AOFFset** <Offset>

Sets the Radio Frame Allocation Offset

**Parameters:**

<Offset> float

Range: 0 to 31
Increment: 1
*RST: 0

**Options:** R&S SMW-K84

**Manual operation:** See "Subframe Config (SIB Type 2)" on page 122

---

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:SC:APER** <AllocPeriod>

Sets the Radio Frame Allocation Period.

**Parameters:**

<AllocPeriod> AP1 | AP2 | AP4 | AP8 | AP16 | AP32

*RST: AP1

**Options:** R&S SMW-K84

**Manual operation:** See "Subframe Config (SIB Type 2)" on page 122

---

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:SC:AVAL** <AllocationValue>

Defines which MBSFN subframes are allocated.

**Parameters:**

<AllocationValue> integer

Range: 0 to #HFFFFFF
Increment: 1
*RST: #H3F

**Options:** R&S SMW-K84

**Manual operation:** See "Subframe Config (SIB Type 2)" on page 122

---

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:UEC** <UeCategory>

Defines the UE category as defined in 3GPP TS 36.306.

**Parameters:**

<UeCategory> USER | C1 | C2 | C3 | C5 | C4

*RST: C5

**Options:** R&S SMW-K84

**Manual operation:** See "UE Category" on page 121

## 9.12 DL Carrier Aggregation Settings

Carrier Aggregation is LTE-A (LTE Rel 10) feature enabled for instruments equipped with software option R&S SMW-K85.

**CELL<ch0>**

Value range <ch0>= 0 .. 4

[:SOURce<hw>]:BB:EUTRa:DL:CA:STATe....447
[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:BB....447
[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:BW....447
[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:CIF....448
[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:DFReq....448
[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:ID....448
[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:INDex....449
[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:POFFset....449
[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:PSTart....449
[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:SCINdex....449
[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:STATe....450
[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:TDELay....450
[:SOURce<hw>]:BB:EUTRa:DL:VIEW:CINDex....450

---

**[:SOURce<hw>]:BB:EUTRa:DL:CA:STATe** <CaGlobalState>

Enables/disables the generation of several component carriers.

**Parameters:**

<CaGlobalState> 0 | 1 | OFF | ON
*RST: OFF

**Options:** R&S SMW-K85

**Manual operation:** See "Activate Carrier Aggregation" on page 113

---

**[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:BB** <BasebandPath>

Determines the baseband block that generates the selected component carrier.

**Parameters:**

<BasebandPath> A | B
*RST: A

**Options:** R&S SMW-K85

**Manual operation:** See "Component Carrier Table" on page 113

---

**[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:BW** <Bandwidth>

Sets the bandwidth of the corresponding component carrier/SCell.

**Parameters:**

<Bandwidth> BW1_40 | BW3_00 | BW5_00 | BW10_00 | BW15_00 | BW20_00

*RST: BW10_00

**Options:** R&S SMW-K85

**Manual operation:** See "Component Carrier Table" on page 113

---

**[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:CIF** <CifPresent>

Defines whether the CIF is included in the PDCCH DCI formats transmitted from the corresponding SCell.

**Parameters:**

<CifPresent> 0 | 1 | OFF | ON

*RST: ON

**Options:** R&S SMW-K85

**Manual operation:** See "Component Carrier Table" on page 113

---

**[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:DFReq** <DeltaFreq>

Sets the frequency offset between the central frequency of corresponding SCell and the frequency of the PCell.

**Parameters:**

<DeltaFreq> float

Range: -40 to 40
Increment: 0.1
*RST: 0

**Options:** R&S SMW-K85

**Manual operation:** See "Component Carrier Table" on page 113

---

**[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:ID** <PhysicalCellId>

Sets the physical Cell ID of the corresponding SCell.

**Parameters:**

<PhysicalCellId> integer

Range: 0 to 503
Increment: 1
*RST: 1

**Options:** R&S SMW-K85

**Manual operation:** See "Component Carrier Table" on page 113

**[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:INDex** <CellIndex>

Sets the cell index of the corresponding SCell, as specified in 36.331 [16]. The SCell Index is required for signaling on the DCI CIF field.

The cell index of the PCell is always 0.

**Parameters:**

<CellIndex> integer

Range: 1 to 7
Increment: 1
*RST: 1

**Options:** R&S SMW-K85

**Manual operation:** See "Component Carrier Table" on page 113

**[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:POFFset** <PowerOffset>

Sets the power offset of the SCells relative to the power level of the PCell.

**Parameters:**

<PowerOffset> float

Range: -80 to 10
Increment: 0.01
*RST: 0

**Options:** R&S SMW-K85

**Manual operation:** See "Component Carrier Table" on page 113

**[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:PSTart** <PdschStart>

Sets the starting symbol of the PDSCH for the corresponding SCell.

**Parameters:**

<PdschStart> integer

Range: 1 to 4
Increment: 1
*RST: 2

**Options:** R&S SMW-K85

**Manual operation:** See "Component Carrier Table" on page 113

**[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:SCINdex** <SchedCellIndex>

Defines the component carrier/cell that signals the UL and DL grants for the selected SCell.

**Parameters:**

<SchedCellIndex> integer

Range: 0 to 7
Increment: 1
*RST: 0

**Options:** R&S SMW-K85

**Manual operation:** See "Component Carrier Table" on page 113

---

**[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:STATe** <CellState>

Activates/deactivates the component carrier/SCell.

**Parameters:**

<CellState> 0 | 1 | OFF | ON

*RST: OFF

**Example:**
```
:SOURce1:BB:EUTRa:DL:CA:CELL1:STATe ON
```

**Options:** R&S SMW-K85

**Manual operation:** See "Component Carrier Table" on page 113

---

**[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:TDELay** <TimeDelay>

Sets the time delay of the SCell relative to the PCell.

**Parameters:**

<TimeDelay> integer

Range: 0 to 1000000000
Increment: 1
*RST: 0

**Options:** R&S SMW-K85

**Manual operation:** See "Component Carrier Table" on page 113

---

**[:SOURce<hw>]:BB:EUTRa:DL:VIEW:CINDex** <DlTpCellIdx>

With enabled carrier aggregation, determines the time plan of which cell index (i.e. component carrier) is displayed.

**Parameters:**

<DlTpCellIdx> integer

Range: 0 to 7
*RST: 0

**Example:**
```
:SOURce1:BB:EUTRa:DL:CA:CELL1:STATe ON
:SOURce1:BB:EUTRa:DL:VIEW:CINDex 1
```

**Manual operation:** See "Cell Index" on page 153

## 9.13 CSI-RS Settings

[:SOURce<hw>]:BB:EUTRa:DL:CSIS:CONFig....451
[:SOURce<hw>]:BB:EUTRa:DL:CSIS:NAP....451
[:SOURce<hw>]:BB:EUTRa:DL:CSIS:POW....451
[:SOURce<hw>]:BB:EUTRa:DL:CSIS:SFDelta?....451
[:SOURce<hw>]:BB:EUTRa:DL:CSIS:SFI....452
[:SOURce<hw>]:BB:EUTRa:DL:CSIS:SFT?....452
[:SOURce<hw>]:BB:EUTRa:DL:CSIS:STATe....452
[:SOURce<hw>]:BB:EUTRa:DL:CSIS:ZP....452
[:SOURce<hw>]:BB:EUTRa:DL:CSIS:ZPDelta?....452
[:SOURce<hw>]:BB:EUTRa:DL:CSIS:ZPI....453
[:SOURce<hw>]:BB:EUTRa:DL:CSIS:ZPT?....453

**[:SOURce<hw>]:BB:EUTRa:DL:CSIS:CONFig** <CsiRsConfig>

**Parameters:**

<CsiRsConfig> integer

Range: 0 to 31
Increment: 1
*RST: 0

**Manual operation:** See "Cell-specific CSI-RS Structure" on page 143

**[:SOURce<hw>]:BB:EUTRa:DL:CSIS:NAP** <CsiRsNumAp>

**Parameters:**

<CsiRsNumAp> AP1 | AP2 | AP4 | AP8

*RST: AP1

**Manual operation:** See "Cell-specific CSI-RS Structure" on page 143

**[:SOURce<hw>]:BB:EUTRa:DL:CSIS:POW** <CsiRsPow>

**Parameters:**

<CsiRsPow> float

Range: -8 to 15
Increment: 0.001
*RST: 0

**Manual operation:** See "Cell-specific CSI-RS Structure" on page 143

**[:SOURce<hw>]:BB:EUTRa:DL:CSIS:SFDelta?**

**Return values:**

<CsiRsOffs> integer

Range: 0 to 79
Increment: 1
*RST: 0

**Usage:** Query only

**Manual operation:** See "Cell-specific CSI-RS Structure" on page 143

---

**[:SOURce<hw>]:BB:EUTRa:DL:CSIS:SFI** <CsiRsSfConf>

**Parameters:**
<CsiRsSfConf> integer
Range: 0 to 154
Increment: 1
*RST: 0

**Manual operation:** See "Cell-specific CSI-RS Structure" on page 143

---

**[:SOURce<hw>]:BB:EUTRa:DL:CSIS:SFT?**

**Return values:**
<CsiRsPeriod> integer
Range: 5 to 80
Increment: 1
*RST: 5

**Usage:** Query only

**Manual operation:** See "Cell-specific CSI-RS Structure" on page 143

---

**[:SOURce<hw>]:BB:EUTRa:DL:CSIS:STATe** <CsiRsState>

**Parameters:**
<CsiRsState> OFF | ON | 1 | 0
*RST: OFF

**Manual operation:** See "Cell-specific CSI-RS Structure" on page 143

---

**[:SOURce<hw>]:BB:EUTRa:DL:CSIS:ZP** <ZeroPow>

**Parameters:**
<ZeroPow> integer
Range: 0 to #HFFFF
Increment: 1
*RST: 0

**Manual operation:** See "ZeroTxPower CSI-RS Structure" on page 142

---

**[:SOURce<hw>]:BB:EUTRa:DL:CSIS:ZPDelta?**

**Return values:**
<ZeroPowOffs> integer

**Usage:** Query only

**Manual operation:** See "ZeroTxPower CSI-RS Structure" on page 142

---

**[:SOURce<hw>]:BB:EUTRa:DL:CSIS:ZPI** <ZeroPowConf>

**Parameters:**
<ZeroPowConf> integer
Range: 0 to 154
*RST: 0

**Manual operation:** See "ZeroTxPower CSI-RS Structure" on page 142

---

**[:SOURce<hw>]:BB:EUTRa:DL:CSIS:ZPT?**

**Return values:**
<ZeroPowPer> integer

**Usage:** Query only

**Manual operation:** See "ZeroTxPower CSI-RS Structure" on page 142

## 9.14 Enhanced PBCH, PDSCH, PMCH Settings

**SUBF<st0>**

Defines the subframe number. Value range <st0>= 0 .. 39. The maximum value depends on the selected sequence length (see [:SOURce<hw>]:BB:EUTRa:SLENgth on page 372).

**ALLoc<ch0>**

Determines the allocation number.

Value range

- for subframes with PBCH, i.e. SUBF0, SUBF10, SUBF20 and SUBF30:
  <ch0> = 0 .. 111
- for all other subframes:
  <ch0> = 0 .. 110

[:SOURce<hw>]:BB:EUTRa:DL:PBCH:MIB....454
[:SOURce<hw>]:BB:EUTRa:DL:PBCH:SOFFset....454
[:SOURce<hw>]:BB:EUTRa:DL:PBCH:SRPeriod....455
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>:CAW....455
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:ISBSize....455
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:RVINdex....456
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:STATe....456
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:TBSize....456

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:TYPE?....457
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:AP....457
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:APM....458
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:CBINdex....458
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:CDD....458
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:DAFormat....459
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:NOLayers....459
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:SCHeme....460
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:SCID....460
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:TRSCheme....461
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SCRambling:STATe....461
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SCRambling:UEID....461

**[:SOURce<hw>]:BB:EUTRa:DL:PBCH:MIB** <State>

(for PBCH only)

Enables/disables transmission of real MIB data.

**Parameters:**

<State> 0 | 1 | OFF | ON

*RST: ON

**Example:** `SOUR:BB:EUTR:DL:PBCH:MIB ON`

**Manual operation:** See "MIB (including SFN)" on page 196

**[:SOURce<hw>]:BB:EUTRa:DL:PBCH:SOFFset** <SfnOffset>

Sets an offset for the start value of the SFN (System Frame Number).

**Parameters:**

<SfnOffset> integer

Range: 0 to 1020
Increment: 4
*RST: 0

**Manual operation:** See "SFN Offset" on page 196

**[:SOURce<hw>]:BB:EUTRa:DL:PBCH:SRPeriod** <SfnRestPeriod>

Determines the time span after which the SFN (System Frame Number) restarts.

By default, the SFN restart period is equal to the ARB sequence length. Selecting a SFN restart period of "1024 Frames", enables the instrument to calculate the PBCH including SFN independently from the other channels. With this setting, the SFN restarts after 1024 frames and the generation process is fully 3GPP compliant, but the calculation may take very long time.

**Parameters:**

<SfnRestPeriod> PER3gpp | PERSlength

**PER3gpp**
Set the SFN restart period to 3GPP (1024 Frames).
**Tip:** Use the "3GPP (1024 Frames)" mode only if 3GPP compliant SFN period is required!

**PERSlength**
Set the SFN restart period to the ARB sequence length.

*RST: PERSlength

**Example:** `BB:EUTR:DL:PBCH:SRP PERS`
sets the restart period to the ARB sequence length.

**Manual operation:** See "SFN Restart Period" on page 196

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>:CAW** <DlCsiAware>

**Parameters:**

<DlCsiAware> OFF | ON | 1 | 0

*RST: OFF

**Manual operation:** See "CSI Awareness" on page 193

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:ISBSize** <SoftBufSize>

Sets the size of the IR soft buffer.

**Parameters:**

<SoftBufSize> integer

Range: 800 to 304000
Increment: 800
*RST: 304000

**Example:**
```
SOUR:BB:EUTR:DL:SUBF9:ALL5:CW:DATA USER3
SOUR:BB:EUTR:DL:SUBF9:ALL5:PHYS?
Response: 2400
SOUR:BB:EUTR:DL:SUBF9:ALL5:CW2:CCOD:TBS 1500
SOUR:BB:EUTR:DL:SUBF9:ALL5:CW2:CCOD:ISBS 1600
SOUR:BB:EUTR:DL:SUBF9:ALL4:CW:DATA USER3
SOUR:BB:EUTR:DL:SUBF9:ALL4:CW2:CCOD:ISBS?
Response: 1600
```

**Manual operation:** See "IR Soft Buffer Size (PDSCH)" on page 197

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:RVINdex** <RedundVersIndex>

Sets the redundancy version index.

**Parameters:**

<RedundVersIndex> integer

Range: 0 to 3
Increment: 1
*RST: 0

**Example:**
```
BB:EUTR:DL:SUBF4:ALL5:CW2:CCOD:RVIN 2
```
sets the redundancy version index to 2

**Manual operation:** See "Redundancy Version Index (PDSCH)" on page 197

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:STATe** <State>

Enables/disables channel coding for the selected allocation and code word.

**Parameters:**

<State> 0 | 1 | OFF | ON

*RST: OFF

**Example:**
```
BB:EUTR:DL:SUBF4:ALL5:CW2:CCOD:STAT OFF
```
disables channel coding for allocation 5 and code word 2

**Manual operation:** See "State Channel Coding (DL)" on page 195

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:TBSize** <TranspBlockSize>

Sets the size of the transport block.

**Note:** The parameter depends on the content type and the global MIMO configuration.

**Parameters:**

<TranspBlockSize> integer

Range: 1 to 100000
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:SUBF9:ALL5:PHYS?`
queries the number of physical bits of allocation 5
`Response: 2400`
`BB:EUTR:DL:SUBF4:ALL5:CW2:CCOD:TBS 1500`
sets the transport block size to of allocation 5 to 1500 bits

**Example:**
```
SOUR:BB:EUTR:DL:SUBF9:ALL5:CW:DATA USER3
SOUR:BB:EUTR:DL:SUBF9:ALL5:PHYS?
Response: 2400
SOUR:BB:EUTR:DL:SUBF9:ALL5:CW:CCOD:TBS 1000
SOUR:BB:EUTR:DL:SUBF9:ALL5:CW2:CCOD:TBS 1500
SOUR:BB:EUTR:DL:SUBF9:ALL4:CW:DATA USER3
SOUR:BB:EUTR:DL:SUBF9:ALL4:CW:CCOD:TBS?
Response: 1000
SOUR:BB:EUTR:DL:SUBF9:ALL4:CW2:CCOD:TBS?
Response: 1500
```

**Manual operation:** See "Transport Block Size/Payload (DL)" on page 196

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:TYPE?**

Queries the used channel coding scheme and channel coding rate.

**Note:** The parameter depends on the allocation's content type.

**Return values:**

<Type> NONE | CONV | TC

*RST: NONE

**Example:** `BB:EUTR:DL:SUBF4:ALL5:CW2:CCOD:TYPE?`
queries the used channel coding scheme and channel coding rate
`Response: TC1/3`
the used coding is turbo coding with 1/3 coding rate

**Usage:** Query only

**Manual operation:** See "Type Channel Coding (DL)" on page 195

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:AP** <AntennaPorts>

Sets the antenna port(s) for the selected transmission mode.

**Parameters:**

<AntennaPorts> AP7 | AP5 | AP8 | AP78 | AP79 | AP710 | AP711 | AP712 | AP713 | AP714

*RST: AP7

**Options:** R&S SMW-K84

**Manual operation:** See "Antenna Ports" on page 191

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:APM** <AntPortMap>

Sets the way that the logical antenna ports are mapped to the physical Tx-antennas. See chapter 7.13, "Antenna Port Mapping Settings", on page 197.

**Parameters:**

<AntPortMap> CB | RCB | FW

*RST: CB

**Options:** R&S SMW-K84

**Manual operation:** See "Antenna Port Mapping" on page 191

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:CBINdex** <CodeBookIndex>

Sets the codebook index for the selected allocation.

The combination of codebook index and the selected number of layers determines the codebook matrix used for precoding.

**Parameters:**

<CodeBookIndex> integer

Range: 0 to 15
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:SUBF4:ALL5:CW:PREC:CBIN 2`
sets the codebook index to 2

**Manual operation:** See "Codebook Index" on page 192

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:CDD** <CyclicDelayDiv>

Sets the CDD for the selected allocation.

The combination of cyclic delay diversity and the selected number of layers determines the precoding parameters for spatial multiplexing.

**Parameters:**

<CyclicDelayDiv> NOCDd | SMDelay | LADelay

**NOCDd**
Zero CDD

**SMDelay**
Small CDD

**LADelay**
Large CDD

*RST: NOCDd

**Example:** `BB:EUTR:DL:SUBF4:ALL5:CW:PREC:CDD SMD`
selects small CDD

**Manual operation:** See "Cyclic Delay Diversity" on page 192

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:DAFormat** <DataFormat>

Switches between the Cartesian (Real/Imag.) and Cylindrical (Magn./Phase) coordinates representation.

**Parameters:**

<DataFormat> CARTesian | CYLindrical

*RST: CART

**Manual operation:** See "Mapping Coordinates" on page 192

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:NOLayers** <NoLayers>

Sets the number of layers for the selected allocation.

The combination of number of code words and number of layers determines the layer mapping for the selected precoding scheme.

**Note:** The number of available layers depends on the selected content type and the precoding scheme.

**Parameters:**

<NoLayers> 1 | 2 | 3 | 4

Range: 1 to 4
Increment: 1
*RST: 1

**Example:** `BB:EUTR:DL:SUBF4:ALL5:CW:PREC:NOL 2`
sets the number of layers to 2

**Manual operation:** See "Number of Layers" on page 191

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:SCHeme** <Scheme>

Selects the precoding scheme. This parameter is available for the first code word only.

**Note:** The available selections depend on the selected content type.

**Parameters:**

<Scheme> NONE | SPM | TXD | BF | TXMS

**NONE**
Disables precoding.

**SPM**
Precoding for spatial multiplexing will be performed according to 3GPP TS 36.211, Version 8.1.0 onwards and the selected parameters.

**TXD**
Precoding for transmit diversity will be performed according to 3GPP TS 36.211, Version 8.1.0 onwards and the selected parameters

**TXMS**
Sets the PDSCH to transmission mode 7, as described in 3GPP TS 36.213, i.e. UE-specific RS will be added to the PDSCH.

**BF**
Sets the PDSCH to transmission mode selected with the command `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:TRSCheme`.

*RST: NONE

**Example:**
```
SOUR:BB:EUTR:DL:SUBF4:ALL5:CONT PDSC
BB:EUTR:DL:SUBF4:ALL5:CW:PREC:SCH SPM
```
sets the precoding scheme to spatial multiplexing

**Manual operation:** See "Precoding Scheme" on page 189

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:SCID** <ScrambIdentity>

Sets the scrambling identity according to 36.211, sec. 6.10.3.1.

This value is used for initialization of the sequence used for generation of the UE-specific reference signals.

**Parameters:**

<ScrambIdentity> integer

Range: 0 to 1
Increment: 1
*RST: 0

**Manual operation:** See "Scrambling Identity n_SCID" on page 191

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:TRSCheme** <TransmissScheme>

Determines the transmission mode (see also table 3-3).

**Parameters:**

<TransmissScheme> TM7 | TM8
*RST: TM7

**Options:** R&S SMW-K84

**Manual operation:** See "Transmission Scheme" on page 190

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SCRambling:STATe** <State>

Enables/disables the bit-level scrambling.

**Parameters:**

<State> ON | OFF
*RST: ON

**Example:**
```
SOUR:BB:EUTR:DL:SUBF0:ALL5:CW:DATA PN9
SOUR:BB:EUTR:DL:SUBF0:ALL5:CW:SCR:STAT ON
```
enables scrambling

**Example:** If a "User 1..4" is selected for the Data Source for the corresponding allocation, this command is query only and the return value corresponds the state determined with the command `[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SCRambling:STATe`.
```
SOUR:BB:EUTR:DL:SUBF0:ALL4:CW:DATA USER3
SOUR:BB:EUTR:DL:USER3:SCR:STAT ON
SOUR:BB:EUTR:DL:SUBF0:ALL4:CW:SCR:STAT?
Response: On
```

**Manual operation:** See "State Scrambling (DL)" on page 194

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SCRambling:UEID** <Ueid>

Sets the user equipment identifier (n_RNTI) of the user to which the PDSCH transmission is intended. The UE ID is used to calculate the scrambling sequence.

**Parameters:**

<Ueid> integer
Range: 0 to 65535
Increment: 1
*RST: 0

**Example:**
```
BB:EUTR:DL:SUBF0:ALL5:CW:UEID 120
```
sets the user equipment identifier.

**Manual operation:** See "UE ID/n_RNTI (PDSCH)" on page 194

## 9.15 Enhanced PCFICH, PHICH and PDCCH Configuration

**SUBF<st0>**

Defines the subframe number. Value range <st0>= 0 .. 39. The maximum value depends on the selected sequence length (see [:SOURce<hw>]:BB:EUTRa:SLENgth on page 372).

**ITEM<ch0>**

Value range <ch0>= 0 .. 19

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:STATe....464
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PRECoding:SCHeme....464
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PRECoding:NOLayers?....465
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PCFich:POWer....465
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PCFich:SCRambling:STATe....466
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PCFich:CREGion....466
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh:PMODe....467
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh:POWer....467
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh:GROup<ch0>:
ITEM<user0>:POW....467
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh:NOGRoups....468
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh:ANPattern<ch0>....468
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:POWer....468
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:SCRambling:STATe....469
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:BITS....469
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:AVRegs....469
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:AVCCes....470
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:FORMat....470
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:NOPDcchs....471
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:ALRegs....472
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DREGs....472
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DATA....473
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:PATTern....473
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DSELect....473
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:TRSource....474
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:DATA....474
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:DSELect....474
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:PATTern....475
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:SITem....475
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:APPend....476
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:INSert....476
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:DELete....476
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:DOWN....476
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:UP....476
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:SOLVe?....477
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:RESet....477

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIFmt.....477
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:UEID.....477
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:CELL.....478
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**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:STATe** <State>

Enables/disables the PDCCH, PCFICH and PHICH allocation.

**Parameters:**

<State> 0 | 1 | OFF | ON

*RST: ON

**Example:** `BB:EUTR:DL:SUBF1:ENCC:STAT ON`
enables PDCCH

**Manual operation:** See "General PCFICH/PHICH/PDCCH Configuration" on page 163

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PRECoding:SCHeme** <Scheme>

Selects the precoding scheme for PDCCH.

**Parameters:**

<Scheme> NONE | TXD

**NONE**
Disables precoding.

**TXD**
Precoding for transmit diversity will be performed according to 3GPP TS 36.211 and the selected parameters

*RST: NONE

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PREC:SCH TXD`
selects the precoding scheme

**Manual operation:** See "General PCFICH/PHICH/PDCCH Configuration" on page 163

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PRECoding:NOLayers?**

Queries the number of layers for PDCCH.

This value is fixed to 1 for PDCCH.

**Return values:**

<LayerCount> integer

Range: 1 to 2
Increment: 1
*RST: 1

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PREC:NOL?`
queries the number of layers
`Response: 1`

**Usage:** Query only

**Manual operation:** See "General PCFICH/PHICH/PDCCH Configuration" on page 163

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PCFich:POWer** <Power>

Sets the power of the PCFICH ($P_{PCFICH}$).

**Parameters:**

<Power> float

Range: -80.00 to 10.00
Increment: 0.001
*RST: 0

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PCF:POW -5`
sets the power of the PCFICH to -5 dBm

**Manual operation:** See "PCFICH Power" on page 163

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PCFich:SCRambling:STATe**
<State>

Enables/disables the scrambling of the PCFICH.

**Parameters:**
<State> 0 | 1 | OFF | ON
*RST: ON

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PCF:SCR:STAT ON`
enables scrambling of the PCFICH

**Manual operation:** See "General PCFICH/PHICH/PDCCH Configuration" on page 163

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PCFich:CREGion**
<ControlRegion>

Sets the number of OFDM Symbols to be used for PDCCH.

Whether 1, 2, 3 or 4 OFDM Symbols can be reserved for PDCCH depends on the parameters given in the following table.

| Channel Bandwidth | PHICH Duration | Dupplexing Mode | Normal Subframe | Special Subframe |
|---|---|---|---|---|
| No RB > 10 | Normal | FDD | 1,2,3 | - |
| | Normal | TDD | 1,2,3 | 1,2 |
| | Extended | FDD | 3 | - |
| | Extended | TDD | 3 | 2 |
| | Normal | FDD | 2,3,4 | - |
| No RB <=10 | Normal | TDD | 2,3,4 | 2 |
| | Extended | FDD | 3,4 | - |
| | Extended | TDD | 3,4 | 2 |

**Parameters:**
<ControlRegion> integer
Range: 1 to 4
Increment: 1
*RST: 2

**Example:** `BB:EUTR:PHIC:DUR NORM`
selects PHICH normal duration
`BB:EUTR:DL:SUBF1:ENCC:PCF:CREG 1`
sets the control region

**Manual operation:** See "Control Region for PDCCH" on page 163

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh:PMODe** <PowerMode>

Determines whether all PHICH in a PHICH group are send with the same power or enables the adjustment of each $P_{PHICH}$ individualy.

**Parameters:**

<PowerMode> CONSt | IND

**CONSt**
The power of a PHICH (PPHICH) in a PHICH group is set with the command `SOUR:BB:EUTR:DL:ENCC:PHIC:POW`.

**IND**
The power of the individual PHICHs is set with the command

*RST: CONSt

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PHIC:PMOD CONS`
sets the power mode
`BB:EUTR:DL:SUBF1:ENCC:PHIC:POW -5`
sets the power of one PHICHs to -5 dB; all PHICHs in the PHICH group are send with this power.

**Manual operation:** See "Power Mode" on page 165

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh:POWer** <Power>

Sets the power of one PHICH ($P_{PHICH}$) in a PHICH group, i.e. the total power of one PHICH group is the sum of the power of the transmitted PHICHs whitin this group.

**Parameters:**

<Power> float

Range: -80.00 dB to 10.00 dB
Increment: 0.001
*RST: 0 dB

**Example:**
```
SOUR:BB:EUTR:DL:SUBF2:ENCC:PHIC:PMOD CONS
SOUR:BB:EUTR:DL:SUBF2:ENCC:PHIC:NOGR 1
SOUR:BB:EUTR:DL:SUBF2:CYCP NORM
SOUR:BB:EUTR:DL:SUBF2:ENCC:PHIC:ANP1 '1---1---'
SOUR:BB:EUTR:DL:SUBF2:ENCC:PHIC:POW - 3
```
sets the power of one PHICHs in a PHICH group to -3 dB

**Manual operation:** See "PHICH Power" on page 165

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh:GROup<ch0>:ITEM<user0>:POW** <Power>

Sets the power of the individual PHICHs.

**Parameters:**

<Power> float

Range: -80.00 dB to 10.00 dB
Increment: 0.001 dB
*RST: 0 dB

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PHIC:PMOD IND`
sets the power mode
`BB:EUTR:DL:SUBF1:ENCC:PHIC:GRO1:ITEM4:POW -5`
sets the power of the PHICH#5 in the second PHICH group to -5 dB

**Manual operation:** See "Power Settings Config." on page 166

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh:NOGRoups** <GroupCount>

Sets the number of available PHICH groups.

**Parameters:**

<GroupCount> integer

Range: 0 to 56
Increment: 1
*RST: 2

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PHIC:NOGR 4`
sets the number of PHICH groups

**Manual operation:** See "Number of PHICH Groups" on page 165

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh:ANPattern<ch0>** <AnPattern>

Sets the ACK/NACK pattern for the corresponding PHICH group.

A "1" indicates an ACK, a "0" - a NACK, a "-" indicates DTX.

**Suffix:**

<ch0> 0 .. 59

**Parameters:**

<AnPattern> string

Range: 0 to 15
*RST: 0

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PHIC:ANP2 '1010--11'`
sets the ACK/NACK pattern for PHICH Group number 2

**Manual operation:** See "ACK/NACK Pattern Group 0 .. 9" on page 165

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:POWer** <Power>

Sets the power of the PDCCH ($P_{PDCCH}$).

The value set with this parameter is also displayed in the allocation table for the corresponding allocation.

**Parameters:**

<Power> float

Range: -80.00 to 10.00
Increment: 0.001
*RST: 0

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:POW -5`
sets the power of the PDCCH to -5dB

**Manual operation:** See "PDCCH Power" on page 167

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:SCRambling:STATe** <State>

Enables/disables the scrambling.

**Parameters:**

<State> 0 | 1 | OFF | ON

*RST: ON

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:SCR:STAT ON`
enables scrambling

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:BITS** <PhysBits>

Defines the number of bits allocated for PDCCH.

**Parameters:**

<PhysBits> integer

Range: 0 to 100000
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:SUBF1:ENCC:STAT ON`
enables PDCCH.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:BITS?`
queries the number of bits
`Response: 3144`

**Manual operation:** See "Number of Bits / REGs / CCEs (PDCCH)" on page 167

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:AVRegs** <AvailRegionCoun>

Defines the number of the REGs that are available for the PDCCH allocation.

**Parameters:**

<AvailRegionCoun> integer

Range: 0 to 100000
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:SUBF1:ENCC:STAT ON`
enables PDCCH.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:AVR?`
queries the number of REGs
`Response: 393`

**Manual operation:** See "Number of available REGs (PDCCH)" on page 167

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:AVCCes** <AvailCceCount>

Queries the number of the control channel elements (CCEs) that are available for the PDCCH allocation.

**Parameters:**

<AvailCceCount> integer

Range: 0 to 100000
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:SUBF1:ENCC:STAT ON`
enables PDCCH.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:AVCC?`
queries the number of CCEs
`Response 43`

**Manual operation:** See "Number of available CCEs (PDCCH)" on page 168

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:FORMat** <Format>

Sets the PDCCH format.

The PDCCH format determines how many CCEs (control channel elements) will be used for the transmission of the PDCCH.

**Parameters:**

<Format> VAR | -1 | 0 | 1 | 2 | 3

**VAR**
Enables full flexibility by the configuration of the downlink control information (DCI) format and content.

**-1**
Proprietary format for legacy support.
Disables precoding.
This format corresponds to the transmission of one PDCCH on all available REGs, i.e.
# REGs available$_{PDCCH}$ = #REGs allocated$_{PDCCH}$,
#PDCCH=1,
#DummyREGs=0.
This format has to be used while performing signal analysis with R&S FSQ.

**0**
One PDCCH is transmitted on one CCE, i.e. 9 REGs.

**1**
One PDCCH is transmitted on two CCEs, i.e. 18 REGs.

**2**
One PDCCH is transmitted on four CCEs, i.e. 36 REGs.

**3**
One PDCCH is transmitted on eight CCEs, i.e. 72 REGs.

*RST: VAR

**Example:** `BB:EUTR:DL:SUBF2:ENCC:PDCC:FORM 0`
sets the PDCCH format.

**Manual operation:** See "PDCCH Format" on page 168

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:NOPDcchs**
<PdcchCount>

Sets the number of PDCCHs to be transmitted.

The maximum number PDCCH that can be transmitted on the available REGs for PDCCH deppends on the number of REGs (#REG) reserved for the transmission of one PDCCH, i.e. depends on the selected PDCCH format and is calculated as follow:

#PDCCH = # REGs available$_{PDCCH}$ / #REG.

**Parameters:**

<PdcchCount> integer

Range: 0 to max
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:SUBF2:ENCC:PDCC:FORM 0`
sets the PDCCH format.
`BB:EUTR:DL:SUBF2:ENCC:PDCC:NOPD 20`
sets the number of PDCCHs.

**Manual operation:** See "Number of PDCCHs" on page 169

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:ALRegs**
<AllocRegionCoun>

Defines the number of REGs that are actually allocated for PDCCH transmission (#REGs allocated$_{PDCCH}$).

**Parameters:**
<AllocRegionCoun> integer
Range: 0 to 100000
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:SUBF2:ENCC:PDCC:FORM 0`
sets the PDCCH format.
`BB:EUTR:DL:SUBF2:ENCC:PDCC:NOPD 20`
sets the number of PDCCHs.
`BB:EUTR:DL:SUBF2:ENCC:PDCC:ALR?`
queries the number of REGs
`Response: 180`

**Manual operation:** See "Number of REGs allocated to PDCCH" on page 169

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DREGs**
<DummyRegsCount>

Defines the the number of REGs that are available for the PDCCH allocation but are not allocated.

**Parameters:**
<DummyRegsCount> integer
Range: 0 to 100000
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:SUBF2:ENCC:PDCC:FORM 0`
sets the PDCCH format.
`BB:EUTR:DL:SUBF2:ENCC:PDCC:NOPD 20`
sets the number of PDCCHs.
`BB:EUTR:DL:SUBF2:ENCC:PDCC:ALR?`
queries the number of REGs
`Response: 180`
`BB:EUTR:DL:SUBF2:ENCC:PDCC:DREG?`
queries the number of dummy REGs
`Response: 213`

**Manual operation:** See "Number of Dummy REGs" on page 169

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DATA** <Data>

Selects the data source for PDCCH.

**Parameters:**

<Data> PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATTern | DLISt | ZERO | ONE

*RST: PN9

**Example:** `BB:EUTR:DL:SUBF2:ENCC:PDCC:FORM 0`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:DATA PN9`
PN9 is selected as data source

**Manual operation:** See "Data Source (PDCCH)" on page 169

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:PATTern** <Pattern>

Selects the bit pattern for the `PATT` selection.

**Parameters:**

<Pattern> <bit pattern>

*RST: #H0,1

**Example:** `BB:EUTR:DL:SUBF2:ENCC:PDCC:FORM 0`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:DATA PATT`
Pattern is selected as data source
`BB:EUTR:DL:SUBF1:ENCC:PDCC:PATT #H3F,8`
defines the bit pattern.

**Manual operation:** See "DList/Pattern (PDCCH)" on page 170

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DSELect** <Filename>

Selects the data list for the DLISt data source selection.

The lists are stored in a directory of the user's choice. The directory applicable to the following commands is defined with the command `MMEMory:CDIR`. To access the files in this directory, you only have to give the file name, without the path and the file extension.

**Parameters:**

<Filename> string

**Example:** `BB:EUTR:DL:SUBF2:ENCC:PDCC:FORM 0`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:DATA DLIS`
selects the Data Lists data source.
`MMEM:CDIR '/var/user/temp/Lists'`
selects the directory for the data lists.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:DSEL 'eutra_pdcch'`
selects file `eutra_pdcch` as the data source. This file must be in the directory `/var/user/temp/Lists`

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:TRSource**
<TranSource>

Sets the behavior of the dummy REGs, i.e. determines whether dummy data or DTX is transmitted.

**Parameters:**
<TranSource> DATA | DTX
*RST: DATA

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:DCR:TRS DATA`
DATA wil be transmitted

**Manual operation:** See "Dummy CCE REGs" on page 170

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:DATA**
<Data>

Selects the data source for PDCCH.

**Parameters:**
<Data> PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATTern | DLISt | ZERO | ONE
*RST: PN9

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:DCR:DATA PN9`
PN9 is selected as data source

**Manual operation:** See "Dummy CCE Data Source" on page 171

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:DSELect**
<Filename>

Selects the data list for the DLISt data source selection.

The lists are stored in a directory of the user's choice. The directory applicable to the following commands is defined with the command `MMEMory:CDIR`. To access the files in this directory, you only have to give the file name, without the path and the file extension.

**Parameters:**
<Filename> string

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:DCR:DATA DLIS`
selects the Data Lists data source.
`MMEM:CDIR '/var/user/temp/Lists'`
selects the directory for the data lists.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:DCR:DSEL 'eutra_pdcch'`
selects file `eutra_pdcch` as the data source. This file must be in the directory `/var/user/temp/Lists`

**Manual operation:** See "DList/Pattern (Dummy CCE)" on page 171

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:PATTern**
<Pattern>

Selects the bit pattern for the `PATT` selection.

**Parameters:**
<Pattern> <bit pattern>
*RST: #H0,1

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:DCR:DATA PATT`
Pattern is selected as data source
`BB:EUTR:DL:SUBF1:ENCC:PDCC:DCR:PATT #H3F,8`
defines the bit pattern.

**Manual operation:** See "DList/Pattern (Dummy CCE)" on page 171

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:SITem**
<SelectedItem>

Selects an PDCCH item, i.e. a row in the DCI table.

**Parameters:**
<SelectedItem> integer
Range: 0 to 19
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:SIT 2`
selects the third row in the DCI table

**Manual operation:** See "Insert" on page 171

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:APPend**

Adds a new row at the end of the DCI table.

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:APP`
adds a new row

**Manual operation:** See "Append" on page 171

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:INSert**

Insert a new row before the currently selected item.

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:SIT 2`
selects the third row in the DCI table
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:INS`
inserts a new row before the third one

**Manual operation:** See "Insert" on page 171

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:DELete**

Deletes the selected row.

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:SIT 2`
selects the third row in the DCI table
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:DEL`
deletes the third row

**Usage:** Event

**Manual operation:** See "Delete" on page 171

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:DOWN**
**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:UP**

Moves the selected row down or up.

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:SIT 2`
selects the third row in the DCI table
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:UP`
moves the third row one row up

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:SOLVe?**

Triggers a built-in algorithm that re-assigns automatically the CCE values depending on the configured "Search Space"; previously configured CCE values will not be maintained.

If the conflict can not be resolved automatically, the values are left unchanged.

**Example:** `:SOURce:BB:EUTRa:DL:SUBF1:ENCC:PDCCh:EXTC:SOLVe`

**Usage:** Query only

**Manual operation:** See "Resolve Conflicts" on page 172

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:RESet**

Resets the table.

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:RES`
resets the table

**Manual operation:** See "Reset" on page 172

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:**
**DCIFmt** <DciFormat>

Sets the DCI format for the selected PDCCH.

**Parameters:**

<DciFormat> F0 | F1 | F1A | F1B | F1C | F1D | F2 | F2A | F3 | F3A | F2B
*RST: F0

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1`
sets the DCI format

**Manual operation:** See "DCI Table" on page 172

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:**
**UEID** <Ueid>

Sets the n_RNTI for the selected PDCCH.

**Parameters:**

<Ueid> integer

Range: 0 to 65535
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:UEID 100`
sets the n_RNTI

**Manual operation:** See "DCI Table" on page 172

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:CELL** <CellIdx>

Determines the component carrier the corresponding DCI is transmitted on.

**Parameters:**

<CellIdx> integer

Range: 0 to 7
Increment: 1
*RST: 0

**Options:** R&S SMW-K85

**Manual operation:** See "DCI Table" on page 172

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:PFMT** <Format>

Sets the PDCCH format for the selected PDCCH.

**Parameters:**

<Format> integer

Range: 0 to 3
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets PDCCH format variable.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:PFMT 0`
sets the PDCCH format.

**Manual operation:** See "DCI Table" on page 172

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:NCCes** <CceCount>

Defines the number of control channel elements used for the transmission of the PDCCH.

**Parameters:**

<CceCount> integer

Range: 0 to 100000
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:NCC?`
queries the number of CCEs

**Manual operation:** See "DCI Table" on page 172

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:CINDex** <CceIndex>

Sets the CCE start index.

**Parameters:**

<CceIndex> integer

Range: 0 to 100000
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:CIND 10`
sets the CCE start index

**Manual operation:** See "DCI Table" on page 172

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:NDCCes** <DummyCceCount>

Defines the number of dummy CCEs that are appended to the PDCCH.

**Parameters:**

<DummyCceCount> integer

Range: 0 to 100000
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:NDCC?`
queries the number of dummy CCEs

**Manual operation:** See "DCI Table" on page 172

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:CONFlict?**

Indicates a conflict between two DCI formats.

**Return values:**

<Conflict> ON | OFF

*RST: OFF

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:CONF?`
queries whether there is a conflict or not.

**Usage:** Query only

**Manual operation:** See "DCI Table" on page 172

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:USER** <User>

Selects the User the DCI is dedicated to.

The available "DCI Formats" depend on the value of this parameter.

**Parameters:**

<User> USER1 | USER2 | USER3 | USER4 | PRNTi | SIRNti | RARNti | NONE

*RST: USER1

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:USER USER2`
the DCI is dedicated to User 2

**Manual operation:** See "DCI Table" on page 172

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:SESPace** <SearchSpace>

If enabled, this parameter configures the PDCCH DCI to be transmitted within the common or UE-specific search space.

Note: The 3GPP specification defines two kinds of search spaces, the common and the UE-specific (`UE`) search space. Avoid the use of the `AUTO` and `OFF` values; this values are provided for backwards compatibility reasons only.

**Parameters:**

<SearchSpace> OFF | AUTO | COMMon | UE | ON | 0 | 1

*RST: OFF

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:SESP UE`
the DCI is transmitted within the UE-specific search space.

**Manual operation:** See "DCI Table" on page 172

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:BITData?**

Queries the resulting bit data as selected with the DCI format parameters.

**Return values:**
<BitData> string

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:BITD?`
queries the bit data

**Usage:** Query only

**Manual operation:** See "Bit Data" on page 176

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:CIField** <CaIndField>

The CIF is present in **each** DCI Format and indentifies the component carrier that carries the PDSCH or PUSCH for the particuliar PDCCH in the cross-carrier approach (see figure 3-25).

**Parameters:**
<CaIndField> integer

Range: 0 to 7
Increment: 1
*RST: 0

**Example:**
```
BB:EUTR:DL:CA:STAT ON
BB:EUTR:DL:USER2:CA:STAT ON
BB:EUTR:DL:CA:CELL0:CIF ON
BB:EUTR:DL:ENCC:PDCC:EXTC:ITEM1:DCIC:CIF 1
```

**Options:** R&S SMW-K85

**Manual operation:** See "Carrier Indicator Field (CIF)" on page 176

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:F1AMode** <Format1aMode>

Selects the mode of the DCI format.

**Parameters:**
<Format1aMode> PDSCh | PRACh

*RST: PDSCh

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1A`
sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:F1AM PRAC`
sets the mode

**Manual operation:** See "DCI Format 1A" on page 180

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:PRACh:PRINdex** <PreambleIndex>

(PRACH mode only)

Sets the DCI Format 1A field Preamble index.

**Parameters:**
<PreambleIndex> integer
Range: 0 to 63
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1A`
sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:F1AM PRAC`
sets the mode
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:PRAC:PRIN 10`
sets the preamble indexe

**Manual operation:** See "DCI Format 1A" on page 180

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:PRACh:MINDex** <MaskIndex>

(PRACH mode only)

Sets the DCI Format 1A field PRACH Mask Index.

**Parameters:**
<MaskIndex> integer
Range: 0 to 15
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1A`
sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:F1AM PRAC`
sets the mode
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:PRAC:MIND 10`
sets the preamble indexe

**Manual operation:** See "DCI Format 1A" on page 180

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:CSIRequest** <CsiRequest>

Sets the DCI Format 0 field CSI/CQI Request.

**Parameters:**
<CsiRequest> integer
Range: 0 to 3
Increment: 1
*RST: 0

**Example:**
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F0
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:CSIR 1
```

**Manual operation:** See "DCI Format 0" on page 177

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:CSDMrs** <CyclicShftDmRs>

Sets the DCI Format 0 field cyclic shift for DMRS.

**Parameters:**
<CyclicShftDmRs> integer
Range: 0 to 7
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F0`
sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:CSDM 1`
sets the cyclic shift

**Manual operation:** See "DCI Format 0" on page 177

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:DLAindex** <DlAssignIndex>

(Enabled for TDD mode only)

Sets the DCI Format 0/1A/1B/1D/2/2A field downlink assignment index.

**Parameters:**

<DlAssignIndex> integer

Range: 0 to 3
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DUPL TDD`
selects TDD mode.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F0`
sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:DLA 1`
sets the downlink assignment index

**Manual operation:** See "DCI Format 0" on page 177

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:DPOFfset** <DpOffset>

Sets the DCI Format 1D field downlink power offset.

**Parameters:**

<DpOffset> ON | OFF

*RST: OFF

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1D`
sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:DPOF ON`
enables downlink power offset

**Manual operation:** See "DCI Format 1D" on page 184

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:GAP** <Gap>

Sets the DCI Format 1A/1B/1C/1D field GAP value.

**Parameters:**

<Gap> ON | OFF

*RST: OFF

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1C`
sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:GAP ON`
enables gap value

**Manual operation:** See "DCI Format 1A" on page 180

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:HPN** <HarqProcessNumb>

Sets the DCI Format 1/1A/1B/1D/2/2A field HARQ porcess number.

**Parameters:**
<HarqProcessNumb> integer

Range: 0 to 15
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1B`
sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:HPN 5`
sets the HARQ process number

**Manual operation:** See "DCI Format 1" on page 178

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:MCSR** <Mcsr>

Sets the DCI Format 0/1/1A/1B/1C/1D field Modulation and Coding Scheme.

**Parameters:**
<Mcsr> integer

Range: 0 to 31
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1B`
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:MCSR 5`

**Manual operation:** See "DCI Format 0" on page 177

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:NDI** <NewDataIndicat>

Sets the DCI Format 0/1/1A/1B/1D field New Data Indicator.

**Parameters:**

<NewDataIndicat> ON | OFF

*RST: OFF

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1B`
sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:NDI ON`
sets the New Data Indicator

**Manual operation:** See "DCI Format 0" on page 177

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:PFHopping** <FreqHopState>

Sets the DCI Format 0 field PUSCH Frequency Hopping.

**Parameters:**

<FreqHopState> 0 | 1 | OFF | ON

*RST: OFF

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F0`
sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:PFH ON`
enables PUSCH Frequency Hopping

**Manual operation:** See "DCI Format 0" on page 177

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:PMI** <PmiState>

Sets the DCI Format 1B field PMI Confirmation for Precoding.

**Parameters:**

<PmiState> ON | OFF

*RST: OFF

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1B`
sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:PMI ON`
enebles PMI Confirmation for Precoding

**Manual operation:** See "DCI Format 1B" on page 181

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:PRECinfo** <PrecodingInfo>

Sets the DCI Format 2/2A field Precoding Information.

**Parameters:**
<PrecodingInfo> integer
Range: 0 to 63
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F2`
sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:PREC 10`
sets Precoding Information

**Manual operation:** See "DCI Format 2/2A/2B" on page 185

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RAH** <ResAllocHeader>

(Enabled for Channel Bandwidth > 10RBs)

Sets the DCI Format 1/2/2A field Resource Allocation Header.

**Parameters:**
<ResAllocHeader> ON | OFF
*RST: OFF

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F2`
sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:RAH ON`
enebles Resource Allocation Header

**Manual operation:** See "DCI Format 1" on page 178

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RAHR** <Rahr>

Sets the DCI Format 0 field Resource Block Assignment and Hopping Resource Allocation.

**Parameters:**

<Rahr> integer

Range: 0 to 100000
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F0`
sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:RAHR 100`
sets Resource Block Assignment and Hopping Resource Allocation

**Manual operation:** See "DCI Format 0" on page 177

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RAType** <ResAllocType>

Sets the DCI Format 0 field Resource Allocation Type.

**Parameters:**

<ResAllocType> integer

Range: 0 to 1
Increment: 1
*RST: 0

**Manual operation:** See "DCI Format 0" on page 177

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RBA** <ResBlockAssign>

Sets the DCI Format 0/1/1A/1B/1C/1D/2/2A field Resource Block Assignment.

**Parameters:**

<ResBlockAssign> integer

Range: 0 to 268435455
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F0`
sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:RBA 100`
sets Resource Block Assignment

**Manual operation:** See "DCI Format 1" on page 178

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RV** <RedundVersion>

Sets the DCI Format 1/1A/1B/1D field Redundancy Version.

**Parameters:**
<RedundVersion> integer

Range: 0 to 3
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1`
sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:RV 1`
sets the Redundancy Version

**Manual operation:** See "DCI Format 1" on page 178

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:SWAPflag** <SwapFlag>

Sets the DCI Format 2/2A field Transport Block to Codeword Swap Flag.

**Parameters:**
<SwapFlag> ON | OFF

*RST: OFF

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1`
sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:SWAP ON`
enables Transport Block to Codeword Swap Flag

**Manual operation:** See "DCI Format 2/2A/2B" on page 185

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TB1:MCS** <Mcs>
**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TB2:MCS** <Mcs>

Sets the DCI Format 2/2A field Modulation and Coding Scheme.

**Parameters:**

<Mcs> integer

Range: 0 to 31
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F2`
sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:TB1:MCS 5`
sets the Modulation and Coding Scheme for TB1

**Manual operation:** See "DCI Format 2/2A/2B" on page 185

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TB1:NDI** <NewDataIndicat>
**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TB2:NDI** <NewDataIndicat>

Sets the DCI Format 2/2A field New Data Indicator.

**Parameters:**

<NewDataIndicat> ON | OFF

*RST: OFF

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F2`
sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:TB2:NDI ON`
sets the New Data Indicator for TB2

**Manual operation:** See "DCI Format 2/2A/2B" on page 185

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TB1:RV** <RedundVersion>
**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TB2:RV** <RedundVersion>

Sets the DCI Format 2/2A field Redundancy Version.

**Parameters:**

<RedundVersion> integer

Range: 0 to 3
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F2`
sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:TB1:RV 1`
sets the Redundancy Version for TB1

**Manual operation:** See "DCI Format 2/2A/2B" on page 185

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:SID** <ScramIdent>

Enables/disables the DCI Format 2B field Scrambling Identity.

**Parameters:**

<ScramIdent> 0 | 1 | OFF | ON

*RST: OFF

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F2B`
sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:SID ON`
enables the Scrambling Identity

**Options:** R&S SMW-K84

**Manual operation:** See "DCI Format 2/2A/2B" on page 185

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TPCC** <TpcCommand>

Sets the DCI Format 0/1/1A/1B/1D/2/2A field TPC Command for PUSCH.

**Parameters:**

<TpcCommand> integer

Range: 0 to 3
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1B`
sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:TPCC 1`
sets the TPC Command for PUSCH

**Manual operation:** See "DCI Format 0" on page 177

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TPCinstr** <TpcCommand>

Sets the DCI Format 3/3A field TPC Command.

**Parameters:**
<TpcCommand> bit pattern

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F3`
sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:TPC '10100000'`
sets the TPC Command

**Manual operation:** See "DCI Format 3/3A" on page 187

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TPMI** <Tpmi>

Sets the DCI Format 1B/1D field TPMI Information for Precoding.

**Parameters:**
<Tpmi> integer

Range: 0 to 15
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1B`
sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:TPMI 10`
sets the TPMI Information for Precoding

**Manual operation:** See "DCI Format 1B" on page 181

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:ULINdex** <UlIndex>

(Enabled for TDD mode and UL/DL Configuration 0)

Sets the DCI Format 1B/1D field UL Index.

**Parameters:**

<UlIndex> integer

Range: 0 to 3
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DUPL TDD`
selects TDD mode.
`BB:EUTR:TDD:UDC 0`
sets the UL/DL configuration
`BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1B`
sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:ULIN 1`
sets the UL Index

**Manual operation:** See "DCI Format 0" on page 177

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:VRBA** <VrbAssignState>

Sets the DCI Format 1A/1B/1D field Localized/Distributed VRB Assignment.

**Parameters:**

<VrbAssignState> ON | OFF

*RST: OFF

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1B`
sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:VRBA ON`
enables the Localized VRB Assignment

**Manual operation:** See "DCI Format 1A" on page 180

## 9.16 UL Frame Configuration

**SUBF<st0>**

Defines the subframe number. The maximum value depends on the selected sequence length (see `[:SOURce<hw>]:BB:EUTRa:SLENgth` on page 372).

**`ALLoc<ch0>`**

Determines the allocation number (user equipment number). Value range `<ch0>` = 0 .. 3, where 0 refers to UE1

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:CONSubframes:PUCCh....494
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:CONSubframes:PUSCh....494
[:SOURce<hw>]:BB:EUTRa:UL:SFSelection....495
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:CYCPrefix....495
[:SOURce<hw>]:BB:EUTRa:UL:RSTFrame....495
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:CONType....496
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:MODulation....496
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:FORMat....496
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:RBCount....496
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:RBCount?....496
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:SET<user>:RBCount....496
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:VRBoffset....497
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:SET<user>:VRBoffset....497
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:SLOT<user0>:ALLoc<ch0>:RBOFfset?....497
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:SLOT<user0>:ALLoc<ch0>:PUCCh:RBOFfset?....497
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:SLOT<user0>:ALLoc<ch0>:PUSCh:SET<s2us>:RBOFfset?....497
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PHYSbits?....498
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:PHYSbits?....498
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:PHYSbits?....498
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:POWer....498
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:POWer....498
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:POWer....498
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:STATe....499
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:STATe....499
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:STATe....499
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:CONFlict?....499
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CONFlict?....499
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CONFlict?....499

---

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:CONSubframes:PUCCh** <ConfSubf>
**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:CONSubframes:PUSCh** <ConfSubframes>

Sets the number of configurable subframes. All uplink subframes are filled periodically with the configured subframes with the exception of the Sounding Reference Signal which is set individually for each UE in the "User Equipment" dialog.

**Parameters:**

<ConfSubframes> integer

Range: 1 to 40
Increment: 1
*RST: 1

**Example:**
```
SOURce1:BB:EUTRa:UL:UE1:ID 100
SOURce1:BB:EUTRa:UL:UE2:ID 100
SOURce1:BB:EUTRa:UL:UE1:CONSubframes:PUCCh 10
SOURce1:BB:EUTRa:UL:UE1:CONSubframes:PUSCh 10
SOURce1:BB:EUTRa:UL:UE2:CONSubframes:PUCCh 8
SOURce1:BB:EUTRa:UL:UE2:CONSubframes:PUSCh 8
```

**Manual operation:** See "Number Of PUCCH/PUSCH Configations/Number Of Configurable Subframes" on page 216

---

**[:SOURce<hw>]:BB:EUTRa:UL:SFSelection** <SubFrameSel>

Sets the subframes to be displayed in the resource allocation table.

**Parameters:**

<SubFrameSel> integer

Range: 0 to the end of the ARB sequence
Increment: 1
*RST: 0

**Example:**
```
BB:EUTR:UL:SFS 0
```
queries subframe 0 in the allocation table view.

**Manual operation:** See "Subframe" on page 219

---

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:CYCPrefix** <CyclicPrefix>

(enabled for `BB:EUTR:UL:CPC USER` only)

Sets the cyclic prefix for the selected subframe.

**Parameters:**

<CyclicPrefix> NORMal | EXTended

*RST: NORMal

**Example:**
```
BB:EUTR:UL:CPC USER
```
the cyclic prefix has to be adjusted on subframe basis.
```
BB:EUTR:UL:SUBF6:CYCP NORM
```
a normal prefix is used in subframe 6 in uplink.

**Manual operation:** See "Cyclic Prefix (UL)" on page 220

---

**[:SOURce<hw>]:BB:EUTRa:UL:RSTFrame**

Resets all subframe settings of the selected link direction to the default values.

**Example:**
```
BB:EUTR:UL:RSTF
```
resets the uplink subframe parameters of path A to the default settings.

**Manual operation:** See "Reset All Subframes" on page 220

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:CONType** <ContentType>

Selects the content type for the selected allocation.

**Parameters:**

<ContentType> PUSCh | PUCCh

*RST: PUSCh

**Example:** `BB:EUTR:UL:SUBF4:ALL2:CONT PUSC`
selects PUSCH as type for the selected allocation.

**Manual operation:** See "Content (UL)" on page 220

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:MODulation** <Modulation>

Selects the modulation scheme for the allocation.

**Parameters:**

<Modulation> QPSK | QAM16 | QAM64

*RST: QPSK

**Example:**
```
SOUR:BB:EUTR:UL:SUBF4:ALL2:CONT PUSC
SOUR:BB:EUTR:UL:SUBF4:ALL2:MOD QPSK
```
selects QPSK as modulation scheme for the allocation.

**Manual operation:** See "Modulation/Format" on page 221

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:FORMat** <Format>

Sets the PUCCH Format (1/1a/1b/2/2a/2b/3).

**Parameters:**

<Format> F1 | F1A | F1B | F2 | F2A | F2B | F3

*RST: F1

**Example:**
```
SOUR:BB:EUTR:UL:SUBF4:ALL2:CONT PUCC
SOUR:BB:EUTR:UL:SUBF4:ALL2:FORM F2A
```
sets the PUCCH format

**Manual operation:** See "Modulation/Format" on page 221

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:RBCount** <ResBlockCount>
**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:RBCount?**
**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:SET<user>:RBCount** <NumberOfRBs>

Sets the size of the selected allocation in resource blocks (per slot).

**Suffix:**

<user> 1..2

**Parameters:**

<NumberOfRBs> integer

Range: 0 to 110
Increment: 1
*RST: 0

**Example:**
```
BB:EUTR:UL:UE1:REL R89
BB:EUTR:UL:SUBF0:ALL1:RBC 3
```

**Example:**
```
BB:EUTR:UL:UE2:REL R10
BB:EUTR:UL:SUBF0:ALL2:PUCH:RBC ?
BB:EUTR:UL:SUBF0:ALL2:PUSC:SET1:RBC 4
BB:EUTR:UL:SUBF0:ALL2:PUSC:SET1:VRB 5
BB:EUTR:UL:SUBF0:ALL2:PUSC:SET2:RBC 3
BB:EUTR:UL:SUBF0:ALL2:PUSC:SET2:VRB 15
```

**Manual operation:** See "Set 1/Set 2 No. RB" on page 221

---

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:VRBoffset** <VrbOffset>
**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:SET<user>:VRBoffset** <NumberOfVRBs>

Sets the virtual resource block offset of the selected subframe.

**Suffix:**

<user> 1..2

**Parameters:**

<NumberOfVRBs> integer

Range: 0 to 109
Increment: 1
*RST: 0

**Example:**
```
BB:EUTR:UL:SUBF0:ALL1:VRB 6
BB:EUTR:UL:SUBF0:ALL2:PUSC:SET1:VRB 5
BB:EUTR:UL:SUBF0:ALL2:PUSC:SET1:VRB 15
```

**Manual operation:** See "Set 1/Set 2 Offset VRB" on page 222

---

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:SLOT<user0>:ALLoc<ch0>:RBOFfset?**
**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:SLOT<user0>:ALLoc<ch0>:PUCCh:RBOFfset?**
**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:SLOT<user0>:ALLoc<ch0>:PUSCh:SET<s2us>:RBOFfset?**

Queries the start resource block of the selected allocation in slot n of the subframe.

**Suffix:**

<user0> 0..1

<s2us> 1..2

**Return values:**
<RbOffs> integer
Range: 0 to 109
Increment: 1
*RST: 2

**Usage:** Query only

**Manual operation:** See "Offs PRB Slot (n/n+1)" on page 223

---

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PHYSbits?**
**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:PHYSbits?**
**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:PHYSbits?**

Queries the number of physical bits for the selected allocation. The value is set automatically according to the current allocation settings.

**Return values:**
<PuscPhysBits> integer
Range: -1 to 105600
Increment: 1
*RST: -1

**Usage:** Query only

**Manual operation:** See "Phys. Bits / Total Number of Physical Bits" on page 223

---

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:POWer** <Power>
**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:POWer**
<PuccPower>
**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:POWer**
<PuscPower>

Sets the power for the selected allocation.

**Parameters:**
<PuscPower> float
Range: -80 to 10
Increment: 0.001
*RST: 0

**Example:**
```
BB:EUTR:UL:SUBF4:ALL1:POW 3.00
BB:EUTR:UL:SUBF4:ALL2:PUSH:POW -1.00
BB:EUTR:UL:SUBF4:ALL2:PUCH:POW -1.00
```

**Manual operation:** See "Power (UL)" on page 223

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:STATe** <State>
**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:STATe**
<PuccState>
**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:STATe**
<PuscState>

Sets the allocation state to active or inactive.

**Note:** Disabling an allocation deactivate the PUSCH/PUCCH and the corresponding demodulation reference signal, but does not affect other allocations of the UE or the sounding reference signal.

**Parameters:**
<PuscState> 0 | 1 | OFF | ON
*RST: 1

**Manual operation:** See "State (UL)" on page 223

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:CONFlict?**
**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CONFlict?**
**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CONFlict?**

Indicates a conflict between two allocations.

**Return values:**
<PuscConflict> 0 | 1 | OFF | ON
*RST: OFF

**Usage:** Query only

**Manual operation:** See "Conflict (UL)" on page 224

## 9.17 UL Enhanced Settings

**SUBF<st0>**

Defines the subframe number. The maximum value depends on the selected sequence length (see `[:SOURce<hw>]:BB:EUTRa:SLENgth` on page 372).

**ALLoc<ch0>**

Determines the allocation number (user equipment number). Value range `<ch0>` = 0 .. 3, where 0 refers to UE1.

[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:NDMRs.....500
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:FHOP:STATe.....500
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:FHOP:TYPE.....501
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:FHOP:IIHBits.....501
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:MODE.....501
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:NBUNdled.....502
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:BITS.....502
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:CBITs.....502

[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:PATTern.....503
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CQI:CBITs?.....503
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CQI:BITS.....503
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CQI:PATTern.....503
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:RI:CBITs?.....504
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:RI:BITS.....504
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:RI:PATTern.....505
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:ULSCh:BITS?.....505
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CCODing:TBSize.....505
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CCODing:RVINdex.....506
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:NPAR.....506
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:HARQ:BITS.....506
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:HARQ:CBITs?.....506
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:HARQ:PATTern.....507
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CQI:CBITs?.....507
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CQI:BITS.....508
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CQI:PATTern.....508

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:NDMRs**
<Ndmrs>

Sets the part of the demodulation reference signal (DMRS) index which is part of the uplink scheduling assignment and therefore only valid for the according UE in the according subframe.

This index applies when multiple shifts within a cell are used and is used by the calculation of the DMRS sequence.

**Parameters:**

<Ndmrs> integer

Range: 0 to 11
Increment: 1
*RST: 0

**Example:** `BB:EUTR:UL:SUBF4:ALL2:PUSC:NDMR 3`
sets the n_DRMS

**Manual operation:** See "n(2)_DMRS" on page 252

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:FHOP:STATe**
<State>

Enables/disables frequency hopping for PUSCH.

**Parameters:**

<State> 0 | 1 | OFF | ON

*RST: OFF

**Example:** `BB:EUTR:UL:SUBF4:ALL2:PUSC:FHOP:STAT ON`
enables frequency hopping

**Manual operation:** See "Frequency Hopping" on page 252

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:FHOP:TYPE**
<Type>

Queries the frequency hopping type used, as defined in 3GPP TS36.213.

**Parameters:**

<Type> TP1 | TP2 | NONE
*RST: NONE

**Example:** `BB:EUTR:UL:SUBF4:ALL2:PUSC:FHOP:TYPE?`
queries the frequency hopping type
`Response: TP2`

**Manual operation:** See "Hopping Type" on page 252

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:FHOP:IIHBits**
<InfoInHoppBits>

Sets the information in hopping bits according to the PDCCH DCI format 0 hopping bit definition. This information determines whether type 1 or type 2 hopping is used in the subframe, and - in case of type 1 - additionally determines the exact hopping function to use.

**Parameters:**

<InfoInHoppBits> integer
Range: 0 to 3
Increment: 1
*RST: 1

**Example:** `BB:EUTR:UL:SUBF4:ALL2:PUSC:FHOP:IIHB 0`
sets the information in hopping bits

**Manual operation:** See "Information in Hopping Bits" on page 252

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:MODE**
<Mode>

Sets the ACK/NACK mode to Multiplexing or Bundling according to 3GPP TS 36.212, chapter 5.2.2.6.

ACK/NACK Mode Bundling is defined for TDD duplexing mode only and is the only one available mode for TDD UL/DL Configuration 5.

**Parameters:**

<Mode> MUX | BUNDling
*RST: MUX

**Example:** `BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:MODE MUX`
selects multiplexing HARQ mode

**Manual operation:** See "ACK/NACK Mode" on page 253

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:NBUNdled** <N_Bundled>

For "ACK/NACK Mode Bundling", sets the parameter N_bundled according to 3GPP TS36.212, section 5.2.2.6.

**Parameters:**

<N_Bundled> integer

Range: 1 to 6
Increment: 1
*RST: 1

**Example:**
```
BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:MODE BUND
BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:NBUN 2
```

**Manual operation:** See "N_bundled" on page 254

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:BITS** <Bits>

Sets the number of ACK/NACK bits.

Set this parameter to 0 to deactivate the ACK/NACK transmission for the corresponding subframe.

**Parameters:**

<Bits> integer

Range: 0 to 4
Increment: 1
*RST: 0

**Example:**
```
BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:BITS 2
```
sets the number of A/N bits

**Manual operation:** See "Number of A/N Bits" on page 254

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:CBITs** <Codedbits>

Queries the number of coded ACK/NACK bits.

**Parameters:**

<Codedbits> integer

Range: 0 to max
Increment: 0
*RST: 2

**Example:**
```
BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:BITS 2
```
sets the number of A/N bits
```
BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:CBIT?
Response: 8
```

**Manual operation:** See "Number of Coded A/N Bits" on page 254

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:PATTern** <Pattern>

Sets the ACK/NACK pattern for the PUSCH.

**Parameters:**

<Pattern> <bit pattern>

*RST: #H0,1

**Example:** `BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:ACKT BIT2`
selects 2-bit HARQ-ACK control information
`BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:PATT #B10,2`
sets the ACK/NACK Pattern

**Manual operation:** See "ACK/NACK Pattern" on page 254

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CQI:CBITs?**

Queries the number of coded CQI bits.

**Return values:**

<CodedBits> integer

Range: 0 to max
Increment: 1
*RST: 22

**Example:** `BB:EUTR:UL:SUBF4:ALL2:PUSC:CQI:CBIT?`
queries the number of coded CQI bits

**Usage:** Query only

**Manual operation:** See "Number of Coded CQI Bits" on page 255

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CQI:BITS** <Bits>

Sets the number of CQI bits before channel coding.

**Parameters:**

<Bits> integer

Range: 0 to 64
Increment: 1
*RST: 4

**Example:** `BB:EUTR:UL:SUBF4:ALL2:PUSC:CQI:BITS 30`
sets the number of CQI bits

**Manual operation:** See "Number of CQI Bits" on page 255

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CQI:PATTern** <Pattern>

Sets the CQI pattern for the PUSCH.

The length of the pattern is determined by the number of CQI bits ([:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CQI:BITS).

**Parameters:**

<Pattern> bit pattern

*RST: #H0,1

**Example:** BB:EUTR:UL:SUBF4:ALL2:PUSC:CQI:BITS 6
sets the number of CQI bits
BB:EUTR:UL:SUBF4:ALL2:PUSC:CQI:PATT #B100100,6
sets the CQI pattern

**Manual operation:** See "CQI Pattern" on page 255

---

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:RI:CBITs?**

Queries the number of coded RI bits.

**Return values:**

<CodedRiBits> integer

Range: 0 to max
Increment: 1
*RST: 4

**Example:** BB:EUTR:UL:SUBF4:ALL2:PUSC:RI:BITS 2
sets the number of RI bits
BB:EUTR:UL:SUBF4:ALL2:PUSC:RI:CBIT?
Response: 6

**Usage:** Query only

**Manual operation:** See "Number of Coded RI Bits" on page 255

---

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:RI:BITS** <Bits>

Sets the number of rank indication (RI) bits.

Set this parameter to 0 to deactivate the RI for the corresponding subframe.

**Parameters:**

<Bits> integer

Range: 0 to 2
Increment: 1
*RST: 1

**Example:** BB:EUTR:UL:SUBF4:ALL2:PUSC:CQI:BITS 2
sets the number of RI bits

**Manual operation:** See "Number of RI Bits" on page 254

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:RI:PATTern**
<Pattern>

Sets the RI pattern for the PUSCH.

**Parameters:**

<Pattern> <bit pattern>

*RST: #B0,1

**Example:** `BB:EUTR:UL:SUBF4:ALL2:PUSC:RI:BITS 2`
sets the number of RI bits
`BB:EUTR:UL:SUBF4:ALL2:PUSC:RI:PATT #B10,2`
sets the RI pattern

**Manual operation:** See "RI Pattern" on page 254

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:ULSCh:BITS?**

Queries the number of physical bits used for UL-SCH transmission.

**Return values:**

<PhysBitCount> integer

Range: 0 to max
Increment: 1
*RST: 1500

**Example:** `BB:EUTR:UL:SUBF4:ALL2:PUSC:ULSC:BITS?`
queries the number of physical bits for UL-SCH
`Response: 2000`

**Usage:** Query only

**Manual operation:** See "Number of Coded UL-SCH Bits" on page 255

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CCODing:TBSize** <TranspBlockSize>

Sets the size of the transport block.

**Parameters:**

<TranspBlockSize> integer

Range: 0 to 100000
Increment: 1
*RST: 1500

**Example:** `BB:EUTR:UL:SUBF4:ALL2:PUSC:CCOD:TBS 1500`
sets the size of the transport block

**Manual operation:** See "Transport Block Size/Payload (PUSCH)" on page 256

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CCODing:RVINdex** <RedundVersIndex>

Sets the redundancy version index.

**Parameters:**

<RedundVersIndex> integer

Range: 0 to 3
Increment: 1
*RST: 0

**Example:** `BB:EUTR:UL:SUBF4:ALL2:PUSC:CCOD:RVIN 2`
sets the redundancy version index

**Manual operation:** See "Redundancy Version Index (PUSCH)" on page 256

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:NPAR** <NPar>

Sets the resource index for PUCCH format 1/1a/1b respectively 2/2a/2b respectively 3.

**Parameters:**

<NPar> integer

Range: 0 to n(1)_PUCCH_max / n(2)_PUCCH_max / n(3)_PUCCH_max
Increment: 1
*RST: 0

**Example:** `BB:EUTR:UL:SUBF1:ALL2:PUCC:NPAR 10`
sets the n_PUCCH parameter

**Manual operation:** See "n_PUCCH" on page 257

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:HARQ:BITS** <Bits>

(enabled for PUCCH format 3 only)

Sets the number of ACK/NACK+SR bits before channel coding.

**Parameters:**

<Bits> integer

Range: 1 to 21
Increment: 1
*RST: 1

**Manual operation:** See "PUCCH Format 3 Settings" on page 260

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:HARQ:CBITs?**

(enabled for PUCCH format 3 only)

Queries the number of coded ACK/NACK+SR bits.

**Return values:**
<CBits> integer
Range: 0 to 48
Increment: 1
*RST: 0

**Usage:** Query only

**Manual operation:** See "PUCCH Format 3 Settings" on page 260

---

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:HARQ:PATTern** <Pattern>

Sets the PUCCHACK/NACK pattern or ACK/NACK + SR pattern per subframe.

**Note:** In case of PUCCH format 3, the bits given by this pattern represent the $o^{ACK}$ bits according to 3GPP TS 36.212, i.e. the up to 21 bits that contain ACK/NACK information for up to two codewords and optionally SR.

To enable the generation of signal with ACK/NACK information that vary not only per subframe but also differs over the frames, set an ACK/NACK pattern with more than 1 bit for the PUCCH formats 1a/2a, respectively 2 bits for formats 1b/2b, respectively "Number of ACK/NACK + SR Bits" for format 3.

The ACK/NACK pattern has a maximal length of 32 bits and is read out cyclically.

**Parameters:**
<Pattern> <32-bit pattern>
*RST: #H0,1

**Example:** `BB:EUTR:UL:SUBF4:ALL2:PUCC:HARQ:PATT #B10,2`
sets the ACK/NACK Pattern

**Manual operation:** See "ACK/NACK Pattern / ACK/NACK+SR Pattern" on page 258

---

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CQI:CBITs?**

Queries the number of coded CQI bits.

**Return values:**
<CodedBits> integer
Range: 0 to max
Increment: 1
*RST: 20

**Example:** `BB:EUTR:UL:SUBF4:ALL2:PUCC:CQI:CBIT?`
queries sets the number of coded CQI bits
`Response: 20`
The number of coded CQI bits for PUCCH is always 20.

**Usage:** Query only

**Manual operation:** See "Number of Coded CQI Bits (PUCCH)" on page 260

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CQI:BITS**
<Bits>

Sets the number of CQI bits before channel coding.

**Parameters:**

<Bits> integer

Range: 0 to max
Increment: 1
*RST: 4

**Example:** `BB:EUTR:UL:SUBF4:ALL2:PUCC:CQI:BITS 30`
sets the number of CQI bits

**Manual operation:** See "Number of CQI Bits (PUCCH)" on page 259

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CQI:PATTern**
<Pattern>

Sets the CQI pattern for the PUCCH.

The length of the pattern is determined by the number of CQI bits (`BB:EUTR:UL:SUBF:ALL:PUCC:CQI:BITS`).

**Parameters:**

<Pattern> <bit pattern>

*RST: #B0,1

**Example:** `BB:EUTR:UL:SUBF4:ALL2:PUCC:CQI:BITS 6`
sets the number of CQI bits
`BB:EUTR:UL:SUBF4:ALL2:PUCC:CQI:PATT #B100100,6`
sets the CQI pattern

**Manual operation:** See "CQI Pattern (PUCCH)" on page 260

## 9.18 Configure User

**USER<ch>**

Value range <ch>= [1]|2|3|4

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:AP<dir0>:BB<st0>:REAL....509
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:AP<dir0>:BB<st0>:IMAGinary....509
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:CBINdex....509
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:MAPCoordinates....509
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:MODE....510
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CCODing:STATe....510
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SCRambling:STATe....510
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:UEID....510
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:DATA....511
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:DSELect....511

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:PA....511
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:PATTern....512
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CA:STATe....512
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CAW:STATe....512

**[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:AP<dir0>:BB<st0>:REAL**
<AntPortMapData>
**[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:AP<dir0>:BB<st0>:IMAGinary**
<AntPortMapData>

Defines the mapping of the antenna ports to the physical antennas.

**Suffix:**
<dir0> 5 | 7 | .. 14
antenna port

<st0> 1 to 4
available basebands

**Parameters:**
<AntPortMapData> float
Range: -1 to 1
Increment: 0.01
*RST: 0

**Manual operation:** See "Antenna Port Mapping (User)" on page 201

**[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:CBINdex** <CodeBookIndex>

Sets the codebook index for mapping mode Codebook.

**Parameters:**
<CodeBookIndex> integer
Range: 0 to 15
Increment: 1
*RST: 0

**Options:** R&S SMW-K84

**Manual operation:** See "Antenna Port Mapping (User)" on page 201

**[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:MAPCoordinates** <MapCoord>

Switches between the Cartesian (Real/Imag.) and Cylindrical (Magn./Phase) coordinates representation.

**Parameters:**
<MapCoord> CARTesian | CYLindrical
*RST: CART

**Options:** R&S SMW-K84

**Manual operation:** See "Antenna Port Mapping (User)" on page 201

**[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:MODE** <AntPortMap>

Defines the antenna port mapping method, see Mapping Methods.

**Parameters:**

<AntPortMap> CB | RCB | FW
*RST: FW

**Options:** R&S SMW-K84

**Manual operation:** See "Antenna Port Mapping (User)" on page 201

**[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CCODing:STATe** <State>

Enables/disables channel coding for all allocations belonging to the selected user.

In the allocation table, the Channel Coding State of all allocations for which User 1...4 is selected as "Data Source" is set to the value set with this parameter.

**Parameters:**

<State> 0 | 1 | OFF | ON
*RST: OFF

**Example:** `BB:EUTR:DL:USER2:CCOD:STAT ON`
enables channel coding for allocations belonging to user 2.

**Manual operation:** See "State Channel Coding (User)" on page 150

**[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SCRambling:STATe** <State>

Enables/disables scrambling for all allocations belonging to the selected user.

In the allocation table, the scrambling state of all allocations for which User 1...4 is selected as "Data Source" is set to the value set with this parameter.

**Parameters:**

<State> 0 | 1 | OFF | ON
*RST: ON

**Example:** `SOUR:BB:EUTR:DL:USER3:SCR:STAT OFF`
disables scrambling for allocations belonging to user 3.

```
SOUR:BB:EUTR:DL:SUBF0:ALL4:CW:DATA USER3
SOUR:BB:EUTR:DL:SUBF0:ALL5:CW:DATA USER3
SOUR:BB:EUTR:DL:SUBF0:ALL4:CW:SCR:STAT?
Response: Off
SOUR:BB:EUTR:DL:SUBF0:ALL5:CW:SCR:STAT?
Response: Off
```

**Manual operation:** See "State Scrambling (User)" on page 150

**[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:UEID** <Ueid>

Sets the user equipment ID.

**Parameters:**

<Ueid> integer

Range: 0 to 65535
Increment: 1
*RST: 0

**Example:** `BB:EUTR:DL:USER2:UEID 3308`
sets the UE ID.

**Manual operation:** See "UE ID (User)" on page 151

---

**[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:DATA** <Data>

Selects the data source for the selected user configuration.

**Parameters:**

<Data> PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATTern | DLISt | ZERO | ONE

*RST: PN9

**Example:** `BB:EUTR:DL:USER2:DATA PN9`
PN9 is selected as data source for the user configuration.

**Manual operation:** See "Data Source (User)" on page 151

---

**[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:DSELect** <DSelect>

Selects the data list for the DLISt data source selection.

The lists are stored as files with the fixed file extensions `*.dm_iqd` in a directory of the user's choice. The directory applicable to the following commands is defined with the command `MMEMory:CDIR`. To access the files in this directory, you only have to give the file name, without the path and the file extension.

**Parameters:**

<DSelect> string

**Example:** `BB:EUTR:DL:USER2:DATA DLIS`
selects the Data Lists data source.
`MMEM:CDIR '/var/user/temp/Lists'`
selects the directory for the data lists.
`BB:EUTR:DL:USER2:DSEL 'eutra_list1'`
selects file `eutra_list1` as the data source. This file must be in the directory `/var/user/temp/Lists` and have the file extension `*.dm_iqd`.

**Manual operation:** See "DList Pattern (User)" on page 151

---

**[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:PA** <Power>

Sets PDSCH power factor according to 3GPP TS 36.213, chapter 5.2.

**Parameters:**

<Power> -6.02 | -4.77 | -3.01 | -1.77 | 0 | 0.97 | 2.04 | 3.01

Range: -6.02 to 3.01

*RST: 0

**Example:** `BB:EUTR:DL:USER2:PA 2.04`
selects the P_A

**Manual operation:** See "P_A" on page 151

---

**[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:PATTern** <Pattern>

Selects the bit pattern for the `PATT` selection. The maximum length is 64 bits.

**Parameters:**

<Pattern> <64-bit pattern>

*RST: #H0,1

**Example:** `BB:EUTR:DL:USER2:PATT #H3F,8`
defines the bit pattern.

**Manual operation:** See "DList Pattern (User)" on page 151

---

**[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CA:STATe** <State>

Enables/disables carrier aggregation for the selected user.

**Parameters:**

<State> 0 | 1 | OFF | ON

*RST: 0

**Options:** R&S SMW-K85

**Manual operation:** See "Activate CA" on page 151

---

**[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CAW:STATe** <CuCsiAware>

**Parameters:**

<CuCsiAware> OFF | ON | 1 | 0

*RST: OFF

**Manual operation:** See "CSI Awareness" on page 152

## 9.19 Dummy Data Configuration

[:SOURce<hw>]:BB:EUTRa:DL:DUMD:MODulation....513
[:SOURce<hw>]:BB:EUTRa:DL:DUMD:POWer....513
[:SOURce<hw>]:BB:EUTRa:DL:DUMD:DATA....513
[:SOURce<hw>]:BB:EUTRa:DL:DUMD:DSELect....513
[:SOURce<hw>]:BB:EUTRa:DL:DUMD:PATTern....514

**[:SOURce<hw>]:BB:EUTRa:DL:DUMD:MODulation** <Modulation>

Selects modulation for dummy data.

**Parameters:**

<Modulation> QPSK | QAM16 | QAM64

*RST: QPSK

**Example:** `BB:EUTR:DL:DUMD:MOD QAM16`
QAM16 is selected as modulation for dummy data.

**Manual operation:** See "Modulation (Dummy Data)" on page 147

**[:SOURce<hw>]:BB:EUTRa:DL:DUMD:POWer** <Power>

Sets the power for dummy data.

**Parameters:**

<Power> float

Range: -80.00 dB to 10.00 dB
Increment: 0.001 dB
*RST: 0 dB

**Example:** `BB:EUTR:DL:DUMD:POWer 10.00`
sets the power for dummy data to 10 dB.

**Manual operation:** See "Power (Dummy Data)" on page 148

**[:SOURce<hw>]:BB:EUTRa:DL:DUMD:DATA** <Data>

Selects the data source for dummy data.

**Parameters:**

<Data> PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATTern | DLISt | ZERO | ONE

*RST: PN9

**Example:** `BB:EUTR:DL:DUMD:DATA PN9`
PN9 is selected as data source for dummy data.

**Manual operation:** See "Data Source (Dummy Data)" on page 147

**[:SOURce<hw>]:BB:EUTRa:DL:DUMD:DSELect** <Filename>

Selects the data list for the DLISt data source selection.

The lists are stored as files with the fixed file extensions `*.dm_iqd` in a directory of the user's choice. The directory applicable to the following commands is defined with the command `MMEMory:CDIR`. To access the files in this directory, you only have to give the file name, without the path and the file extension.

**Parameters:**

<Filename> string

**Example:** `BB:EUTR:DL:DUMD:DATA DLIS`
selects the Data Lists data source.
`MMEM:CDIR '/var/user/temp/Lists'`
selects the directory for the data lists.
`BB:EUTR:DL:DUMD:DSELect 'eutra_list1'`
selects file `eutra_list1` as the data source. This file must be in the directory `/var/user/temp/Lists` and have the file extension `*.dm_iqd`.

**Manual operation:** See "Select Data List (Dummy Data)" on page 148

---

**[:SOURce<hw>]:BB:EUTRa:DL:DUMD:PATTern** <Pattern>

Selects the bit pattern for the `PATTern` selection. The maximum length is 64 bits.

**Parameters:**
<Pattern> <bit pattern>
*RST: #H0,1

**Example:** `BB:EUTR:DL:DUMD:PATTern #H1E,8`
defines the bit pattern to #H1E,8.

**Manual operation:** See "Pattern (Dummy Data)" on page 148

## 9.20 User Equipment

**UE<ch>**

Determines the User Equipment. Value range `<ch>`= [1]|2|3|4

**SUBF<ch0>**

Value range `<ch0>`= 0 .. 199

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:RELease....515
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:DACRestart....515
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:ID....516
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:STATe....516
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:MODE....516
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:POWer....517
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:ALRB....517
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:MODulation....517
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:N2DMrs....518
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:PASize?....518
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:STATe....518
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:TNOBits?....519
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:TYPE....519
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:VRBoffset....520
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**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:RELease** <Release>

Determines whether the selected UE is a LTE Release 8/9 or LTE Release 10 UE.

**Parameters:**

<Release> R89 | R10

*RST: R89

**Options:** R&S SMW-K85

**Manual operation:** See "3GPP Release" on page 216

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:DACRestart** <State>

If activated, the data source, the ACK/NACK pattern, the CQI pattern and RI are restarted every subframe.

**Parameters:**
<State> 0 | 1 | OFF | ON
*RST: OFF

**Example:** `BB:EUTR:UL:UE2:PUSC:DACR ON`
enables restarting of the data source every subframe

**Manual operation:** See "Restart Data, A/N, CQI and RI every subframe" on page 226

---

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:ID** <Id>

Sets the radio network temporary identifier (RNTI) of the UE.

**Parameters:**
<Id> integer
Range: 0 to 65535
Increment: 1
*RST: 0

**Example:** `BB:EUTR:UL:UE3:ID 303`
sets the UE ID

**Manual operation:** See "UE ID/n_RNTI (User Equipment)" on page 226

---

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:STATe** <State>

Selects the user equipment state.

**Parameters:**
<State> 0 | 1 | OFF | ON
*RST: ON (UE1); OFF (UE2..UE4)

**Example:** `BB:EUTR:UL:UE2:STAT ON`
activates UE2.

**Manual operation:** See "State (User Equipment)" on page 225

---

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:MODE** <Mode>

Selects whether the user equipment is in standard or in PRACH mode.

**Parameters:**
<Mode> STD | PRACh
*RST: STD

**Example:** `BB:EUTR:UL:UE:MODE STD`
selects the standard mode for UE1.

**Manual operation:** See "Mode" on page 226

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:POWer** <Power>

Sets the power level of the selected UE.

**Parameters:**

<Power> float

Range: -80.00 to 10.00
Increment: 0.001
*RST: 0

**Example:** `BB:EUTR:UL:UE2:POW -5.0`
sets the power of UE2

**Manual operation:** See "UE Power" on page 226

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:ALRB** <AllocResBlocks>

Queries the number of the allocated resource blocks for the selected FRC (`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:TYPE` on page 519). For FRCs A.2.2.2.1 and A.2.2.2.2 this parameter can also be set to different values according to 3GPP TS 36.521-1.

**Parameters:**

<AllocResBlocks> integer

Range: 0 to 110
Increment: 1
*RST: 0

**Example:** `BB:EUTR:UL:UE2:FRC:TYPE A34`
sets the FRC
`BB:EUTR:UL:UE2:FRC:ALRB?`
`Response: 25`

**Manual operation:** See "Allocated Resource Blocks" on page 229

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:MODulation** <Modulation>

Queries the modulation for the selected FRC (`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:TYPE` on page 519).

**Parameters:**

<Modulation> QPSK | QAM16 | QAM64

*RST: QPSK

**Example:** `BB:EUTR:UL:UE2:FRC:TYPE A34`
sets the FRC
`BB:EUTR:UL:UE2:FRC:MOD?`
`Response: QPSK`

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:N2DMrs** <N2Dmrs>

Sets the UE specific part of the demodulation reference signal (DMRS) index for all PUSCH allocation of the selected UE in all subframes.

n(2)_DMRS set for the individual subframes with the command `[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:NDMRs` for the corresponding UE is overwritten.

**Parameters:**

<N2Dmrs> integer

Range: 0 to 11
Increment: 1
*RST: 0

**Example:** `SOUR:BB:EUTR:UL:SUBF4:ALL0:PUSC:NDMR 3`
sets the n(2)_DMRS
`SOUR:BB:EUTR:UL:UE1:FRC:STAT ON`
enables FRC
`SOUR:BB:EUTR:UL:UE1:FRC:N2DM 5`
sets the DMRS index for all PUSCH allocation of the selected UE in all subframes
`SOUR:BB:EUTR:UL:SUBF4:ALL0:PUSH:N2DM?`
`Response: 5`

**Manual operation:** See "n(2)_DMRS (FRC)" on page 229

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:PASize?**

Queries the payload size for the selected FRC (`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:TYPE` on page 519).

**Return values:**

<PayloadSize> integer

Range: 0 to 200000
Increment: 1
*RST: 0

**Example:** `BB:EUTR:UL:UE2:FRC:TYPE A34`
sets the FRC
`BB:EUTR:UL:UE2:FRC:PAS?`
`Response: 2216`

**Usage:** Query only

**Manual operation:** See "Payload Size (FRC)" on page 229

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:STATe** <State>

Enables/disables FRC configuration.

Enabling FRC configuration sets some parameters to their predefined values, i.e. several parameters are displayed as read-only. Reconfiguration of the values of this parameters is possible only after disabling the FRC configuration.

The FRC State is disabled and can not be enabled, if a user defined cyclic prefix (`BB:EUTR:UL:CPC USER`) is selected.

**Parameters:**

<State> 0 | 1 | OFF | ON

*RST: OFF

**Example:** `BB:EUTR:UL:UE2:FRC:STAT ON`
enables FRC

**Manual operation:** See "FRC State" on page 228

---

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:TNOBits?**

Queries the total number of physical bits available for the PUSCH allocation per subframe in case the PUSCH is not shortened because of SRS or bcause it is transmitted in a cell specific SRS subframe.

**Return values:**

<TotalBitCount> integer

Range: 0 to max
Increment: 1
*RST: 0

**Example:** `BB:EUTR:UL:UE2:FRC:TYPE A34`
sets the FRC
`BB:EUTR:UL:UE2:FRC:TNOB?`
`Response: 7200`

**Usage:** Query only

**Manual operation:** See "Physical Bits Per Subframe (Unshortened PUSCH)" on page 229

---

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:TYPE** <Type>

Selects a predefined fixed reference channel according to 3GPP TS 36.141, Annex A, respectively 3GPP TS 36.521-1, Annex A.

**Parameters:**

<Type> A11 | A12 | A13 | A14 | A15 | A21 | A22 | A23 | A31 | A32 | A33 | A34 | A35 | A36 | A37 | A41 | A42 | A43 | A44 | A45 | A46 | A47 | A48 | A51 | A52 | A53 | A54 | A55 | A56 | A57 | A71 | A72 | A73 | A74 | A75 | A76 | A81 | A82 | A83 | A84 | A85 | A86 | UE11 | UE12 | UE21 | UE22 | UE3

*RST: A11

**Example:** `BB:EUTR:UL:UE2:FRC:TYPE A34`
selects FRC A3_4

**Manual operation:** See "FRC" on page 228

---

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:VRBoffset** <VrbOffset>

Sets the virtual resource block (VRB) offset for all PUSCH allocation of the selected UE in all subframes.

VRB Offset set for the individual subframes with the command `[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:VRBoffset` are overwritten.

**Parameters:**

<VrbOffset> integer

Range: 0 to max
Increment: 1
*RST: 2

**Example:**
```
SOUR:BB:EUTR:UL:SUBF4:ALL0:VRB 6
SOUR:BB:EUTR:UL:UE1:FRC:STAT ON
SOUR:BB:EUTR:UL:UE1:FRC:VRB 3
SOUR:BB:EUTR:UL:SUBF4:ALL0:VRB?
Response: 3
```

**Manual operation:** See "Offset VRB (FRC)" on page 229

---

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:PRSTate** <State>

Activates Power Ramping for the PRACH preamble. The start and the end of the preamble is cyclically extended and multiplied with a ramping function (sin^2).

**Parameters:**

<State> 0 | 1 | OFF | ON

*RST: OFF

**Example:**
```
BB:EUTR:UL:UE1:MODE PRAC
BB:EUTR:UL:UE1:PRAC:PRST ON
```

**Manual operation:** See "State PRACH Power Ramping" on page 247

---

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:PRTT** <TransitionTime>

Defines the transition time from beginning of the extended preamble to the start of the preamble itself.

**Parameters:**

<TransitionTime> float

Range: 0 to 0.000030
Increment: 0.0000001
*RST: 0.000020
Default unit: s

**Example:**
```
BB:EUTR:UL:UE1:MODE PRAC
BB:EUTR:UL:UE1:PRAC:PRST ON
BB:EUTR:UL:UE1:PRAC:PRTT 15us
```

**Manual operation:** See "Transition Time" on page 247

---

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:PRFormat** <PreaFormat>

Queries the preamble format.

**Parameters:**

<PreaFormat> integer

Range: 0 to 4
Increment: 1
*RST: 0

**Example:**
```
BB:EUTR:UL:UE1:PRAC:PRF?
```
queries the preamble format.

**Manual operation:** See "Preamble Format (Burst Format)" on page 248

---

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:CFRames** <ConfigFrameCoun>

Queries the number of configurable frames.

**Parameters:**

<ConfigFrameCoun> integer

Range: 1 to 20
Increment: 1
*RST: 1

**Example:**
```
BB:EUTR:UL:UE1:PRAC:CRF?
```
queries the number of frames

**Manual operation:** See "Number of Configurable Frames" on page 248

---

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:RBOFfset** <RbOffset>

Queries the starting RB, as set with the command `[:SOURce<hw>]:BB:EUTRa:UL:PRACh:FOFFset`.

**Parameters:**

<RbOffset> integer

Range: 0 to 104
Increment: 1
*RST: 0

**Example:**
```
BB:EUTR:UL:UE1:PRAC:SUBF2:RBOF?
```
queries the RB offset.

**Manual operation:** See "RB Offset" on page 249

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:FRINdex** <FreqResIndex>

(enabled in TDD duplexing mode only)

Sets the frequency resource index $f_{RA}$ for the selected subframe.

**Parameters:**

<FreqResIndex> integer

Range: 0 to 5
Increment: 1
*RST: 0

**Example:** `BB:EUTR:UL:UE1:PRAC:SUBF2:FRIN 2`
sets the frequency resource index

**Manual operation:** See "Frequency Resource Index" on page 249

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:POWer** <Power>

Sets the PRACH power relative to the UE power. The PRACH power can be adjusted independently for every configured preamble.

**Parameters:**

<Power> float

Range: -80.000 to 10.000
Increment: 0.001
*RST: 0

**Example:** `BB:EUTR:UL:UE1:PRAC:SUBF2:POW -3`
sets the power

**Manual operation:** See "Power (PRACH)" on page 250

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:NCSConf** <NcsConfig>

Selects the Ncs configuration of the selected subframe, i.e. determines the Ncs value for the selected preamble set.

**Parameters:**

<NcsConfig> integer

Range: 0 to 15
Increment: 1
*RST: 0

**Example:** `BB:EUTR:UL:UE1:PRAC:SUBF2:NCSC 2`
sets the Ncs Configuration

**Manual operation:** See "Ncs Configuration" on page 249

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:RSEQuence** <RootSequence>

Selects the logical root sequence index for the selected subframe.

**Parameters:**

<RootSequence> integer

Range: 0 to 838
Increment: 1
*RST: 0

**Example:** `BB:EUTR:UL:UE1:PRAC:SUBF2:RSEQ 200`
sets the root sequence

**Manual operation:** See "Logical Root Sequence Index" on page 249

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:SINDex** <SequenceIndex>

Selects the sequence index v for the selected subframe, i.e. selects which one of the 64 preambles available in a cell will be used.

**Parameters:**

<SequenceIndex> integer

Range: 0 to 63
Increment: 1
*RST: 0

**Example:** `BB:EUTR:UL:UE1:PRAC:SUBF2:SIND 30`
sets the sequence index

**Manual operation:** See "Sequence Index (v)" on page 250

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:DT** <DeltaTime>

Sets the paramter delta_t in us.

**Parameters:**

<DeltaTime> float

Range: -250.00 to 250.00
Increment: 0.01
*RST: 0
Default unit: us

**Example:** `BB:EUTR:UL:UE1:PRAC:SUBF2:DT 300`
sets the parameter delta t

**Manual operation:** See "Delta t/us" on page 250

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:STATe** <State>

Enables/disables the PRACH for the selected subframe.

The subframes available for configuration depend on the selected PRACH configuration.

**Parameters:**

<State> 0 | 1 | OFF | ON

*RST: ON

**Example:** `BB:EUTR:UL:UE1:PRAC:SUBF2:STAT ON`
activates PRACH in subframe 2 for UE1.

**Manual operation:** See "State (PRACH)" on page 250

---

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:DATA** <Data>

Selects the data source for Physical Uplink Shared Channel (PUSCH) of the selected UE. For the selected UE, this data source will be used for the PUSCH channel in every subframe where this channel is configured.

**Parameters:**

<Data> PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATTern | DLISt | ZERO | ONE

*RST: PN9

**Example:** `BB:EUTR:UL:SUBF4:ALL2:CONT PUSC`
sets the content type for the allocation 2 (UE3) to PUSCH.
`BB:EUTR:UL:UE3:PUSC:DATA PN11`
PN11 is selected as data source for PUSCH channel of UE3.

**Manual operation:** See "Data Source (PUSCH)" on page 236

---

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:PATTern** <Pattern>

Selects the bit pattern for the `PATTern` selection. The maximum length is 64 bits.

**Parameters:**

<Pattern> <bit pattern>

*RST: #H0,1

**Example:** `BB:EUTR:UL:UE2:PUSC:DATA PATT`
selectes pattern data as data source for PUSCH channel.
`BB:EUTR:UL:UE2:PUSC:PATT #H3F,8`
defines the bit pattern.

**Manual operation:** See "Data Pattern (PUSCH)" on page 237

---

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:DSELect** <Filename>

Selects the data list for the DLISt data source selection.

The lists are stored as files with the fixed file extensions `*.dm_iqd` in a directory of the user's choice. The directory applicable to the following commands is defined with the command `MMEMory:CDIR`. To access the files in this directory, you only have to give the file name, without the path and the file extension.

**Parameters:**
<Filename> string

**Example:** `BB:EUTR:UL:UE:PUSC:DATA DLIS`
selects the Data Lists data source.
`MMEM:CDIR '/var/user/temp/Lists'`
selects the directory for the data lists.
`BB:EUTR:UL:UE:PUSC:DSELect 'eutra_list1'`
selects file `eutra_list1` as the data source. This file must be in the directory `/var/user/temp/Lists` and have the file extension `*.dm_iqd`.

**Manual operation:** See "Data List (PUSCH)" on page 237

---

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:SCRambling:STATe** <State>

Enables/disables scrambling for all PUSCH allocations of the corresponding UE.

**Parameters:**
<State> 0 | 1 | OFF | ON
*RST: OFF

**Example:** `BB:EUTR:UL:UE2:PUSC:SCR:STAT ON`
enables scrambling for UE2

**Manual operation:** See "State Scrambling (PUSCH)" on page 237

---

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:STATe** <State>

Enables/disables channel coding and multiplexing of data and control information for all PUSCH allocations of the corresponding UE.

**Parameters:**
<State> 0 | 1 | OFF | ON
*RST: OFF

**Example:** `BB:EUTR:UL:UE2:PUSC:CCOD:STAT ON`
enables channel coding for UE2

**Manual operation:** See "State Channel Coding and Multiplexing (PUSCH)" on page 237

---

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:MODE** <Mode>

Defines the information transmitted on the PUSCH.

**Parameters:**

<Mode> COMBined | ULSChonly | UCIonly

**COMBined**
Control information and data is multiplexed into the PUSCH.

**ULSChonly**
Only data is transmitted on PUSCH.

**UCIonly**
Only uplink control information is transmitted on PUSCH.

*RST: ULSChonly

**Example:** `BB:EUTR:UL:UE2:PUSC:CCOD:MODE COMB`
enables multiplexing of the control information (UCI) and data (UL-SCH) on the PUSCH for UE2

**Manual operation:** See "Mode Channel Coding" on page 237

---

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:INTerleaver** <Interleaver>

Enables/disables channel interleaving.

**Parameters:**

<Interleaver> 0 | 1 | OFF | ON

*RST: ON

**Example:** `BB:EUTR:UL:UE2:PUSC:CCOD:INT OFF`
diesales channe linterlaving for UE2

**Manual operation:** See "Channel Interleaver (PUSCH)" on page 238

---

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:ICQioffset** <IcqiOffset>

Sets the CQI offset index for control information MCS offset determination according to 3GPP TS 36.213, chapter 8.6.3.

**Parameters:**

<IcqiOffset> integer

Range: 2 to 15
Increment: 1
*RST: 2

**Example:** `BB:EUTR:UL:UE2:PUSC:CCOD:MODE COMB`
enables multiplexing of the control information (UCI) and data (UL-SCH) on the PUSCH for UE2
`BB:EUTR:UL:UE2:PUSC:CCOD:ICQ 5`
sets the CQI offset index

**Manual operation:** See "I_CQI_offset" on page 238

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:IHARqoffset**
<IHarqOffset>

Sets the HARQ-ACK offset index for control information MCS offset determination according to 3GPP TS 36.213, chapter 8.6.3.

**Parameters:**

<IHarqOffset> integer

Range: 0 to 14
Increment: 1
*RST: 0

**Example:** `BB:EUTR:UL:UE2:PUSC:CCOD:MODE COMB`
enables multiplexing of the control information (UCI) and data (UL-SCH) on the PUSCH for UE2
`BB:EUTR:UL:UE2:PUSC:CCOD:IHAR 5`
sets the HARQ-ACK offset index

**Manual operation:** See "I_HARQ_offset" on page 238

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:IRIoffset** <IRIOffset>

Sets the RI offset index for control information MCS offset determination according to 3GPP TS 36.213, chapter 8.6.3.

**Parameters:**

<IRIOffset> integer

Range: 0 to 12
Increment: 1
*RST: 0

**Example:** `BB:EUTR:UL:UE2:PUSC:CCOD:MODE COMB`
enables multiplexing of the control information (UCI) and data (UL-SCH) on the PUSCH for UE2
`BB:EUTR:UL:UE2:PUSC:CCOD:IRI 5`
sets the RI offset index

**Manual operation:** See "I_RI_offset" on page 238

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:OCQimin**
<ChanCodOCQIMin>

For PUSCH channel coding and multiplexing mode UCI only, sets the parameter O_CQI-Min.

**Parameters:**

<ChanCodOCQIMin> integer

Range: 1 to 472
*RST: 1

**Example:**
```
:SOURce1:BB:EUTRa:UL:UE1:PUSCh:CCODing:MODE UCI
:SOURce1:BB:EUTRa:UL:UE1:PUSCh:CCODing:OCQimin
7
```

**Manual operation:** See "O_CQI-MIN" on page 238

---

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:DRS:POWoffset** <PowerOffset>

Sets the power offset of the Demodulation Reference Signal (DRS) relative to the power level of the PUSCH/PUCCH allocation of the corresponding subframe.

**Parameters:**

<PowerOffset> float

Range: -80.00 dB to 10.00 dB
Increment: 0.001 dB
*RST: 0 dB

**Example:**
```
BB:EUTR:UL:UE2:REFS:DRS:POW -2
```
sets the demodulation reference symbol power offser to -2dB.

**Manual operation:** See "DRS Power Offset" on page 239

---

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:STATe** <State>

Enables/disables sending of SRS for the corresponding UE.

**Parameters:**

<State> ON | OFF

*RST: OFF

**Example:**
```
BB:EUTR:UL:UE2:REFS:SRS:STAT ON
```
enables the SRS for UE2

**Manual operation:** See "SRS State" on page 240

---

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:POWoffset** <PowerOffset>

Sets the power offset of the Sounding Reference Signal (SRS) relative to the power of the corresponding UE.

**Parameters:**

<PowerOffset> float

Range: -80.00 dB to 10.00 dB
Increment: 0.001 dB
*RST: 0 dB

**Example:**
```
BB:EUTR:UL:UE2:REFS:SRS:POW -2
```
sets the sounding reference symbol power offset to -2 dB.

**Manual operation:** See "SRS Power Offset" on page 240

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:CYCShift** <CyclicShift>

Sets the cyclic shift used for the generation of the sounding reference signal CAZAC sequence.

**Parameters:**

<CyclicShift> integer

Range: 0 to 7
Increment: 1
*RST: 0

**Example:** `BB:EUTR:UL:UE2:REFS:SRS:CYCS 5`
sets the SRS cyclic shift for UE2

**Manual operation:** See "SRS Cyclic Shift n_CS" on page 240

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:BHOP** <BandwidthHopp>

Sets the UE specific parameter frequency hopping bandwidth $b_{hop}$, as defined in the 3GPP TS 36.211, chapter 5.5.3.2.

SRS frequency hopping is enabled, if $b_{HOP}<B_{SRS}$.

**Parameters:**

<BandwidthHopp> integer

Range: 0 to 3
Increment: 1
*RST: 0

**Example:** `BB:EUTR:UL:UE2:REFS:SRS:BHOP 2`
sets the SRS hopping bandwidth

**Manual operation:** See "Hopping Bandwidth b_hop" on page 246

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:BSRS** <Bsrs>

Sets the UE specific parameter SRS Bandwidth $B_{SRS}$, as defined in the 3GPP TS 36.211, chapter 5.5.3.2.

**Parameters:**

<Bsrs> integer

Range: 0 to 3
Increment: 1
*RST: 0

**Example:** `BB:EUTR:UL:UE2:REFS:SRS:BSRS 2`
sets the SRS bandwidth configuration

**Manual operation:** See "SRS Bandwidth B_SRS" on page 243

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:ISRS** <Isrs>

Sets the UE specific parameter SRS configuration index $I_{SRS}$. Depending on the selected duplexing mode ([:SOURce<hw>]:BB:EUTRa:DUPLexing), this parameter determines the parameters SRS Periodicity $T_{SRS}$ and SRS Subframe Offset $T_{offset}$ as defined in the 3GPP TS 36.213, Table 8.2-1 (FDD) and 8.2-2 (TDD) respectively.

**Parameters:**

<Isrs> integer

Range: 0 to 644
Increment: 1
*RST: 0

**Example:** BB:EUTR:DUPL FDD
sets the duplexing mode
BB:EUTR:UL:UE2:REFS:SRS:ISRS 22
sets the SRS configuration index

**Manual operation:** See "Configuration Index I_SRS" on page 241

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:TSRS** <PeriodTsrs>

Queries the UE specific parameter SRS periodicity $T_{SRS}$.

The value depends on the selected SRS configuration index $I_{SRS}$ ([:SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:ISRS) and duplexing mode ([:SOURce<hw>]:BB:EUTRa:DUPLexing)as defined in the 3GPP TS 36.213, Table 8.2-1 (FDD) and 8.2-2 (TDD) respectively.

**Parameters:**

<PeriodTsrs> integer

Range: 0 to max
*RST: 0

**Example:** BB:EUTR:DUPL FDD
sets the duplexing mode
BB:EUTR:UL:UE2:REFS:SRS:ISRS 22
sets the SRS configuration index
BB:EUTR:UL:UE2:REFS:SRS:TSRS?
queries the SRS periodicity
Response: 20 ms

**Manual operation:** See "Periodicity T_SRS" on page 241

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:TOFFset?**

Queries the UE specific parameter SRS subframe offset $T_{offset}$.

The value depends on the selected SRS configuration index $I_{SRS}$ ([:SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:ISRS) and duplexing mode ([:SOURce<hw>]:BB:EUTRa:DUPLexing)as defined in the 3GPP TS 36.213, Table 8.2-1 (FDD) and 8.2-2 (TDD) respectively.

**Return values:**

<TOffset> integer

Range: 0 to 320
Increment: 1
*RST: 0

**Example:** BB:EUTR:DUPL FDD
sets the duplexing mode
BB:EUTR:UL:UE2:REFS:SRS:ISRS 22
sets the SRS configuration index
BB:EUTR:UL:UE2:REFS:SRS:TOFF?
queries the SRS subframe offset
Response: 5

**Usage:** Query only

**Manual operation:** See "Subframe Offset T_offset" on page 242

---

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:TRComb** <TransmComb>

Sets the UE specific parameter transmission combn $k_{TC}$, as defined in the 3GPP TS 36.211, chapter 5.5.3.2.

**Parameters:**

<TransmComb> 0 | 1

Range: 0 to 1
Increment: 1
*RST: 0

**Example:** BB:EUTR:UL:UE2:REFS:SRS:TRC 1
sets the SRS transmission comb

**Manual operation:** See "Transmission Comb k TC" on page 246

---

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:NRRC** <Nrrc>

Sets the UE specific parameter frqDomainPosition $n_{RRC}$ , as defined in the 3GPP TS 36.211, chapter 5.5.3.2.

**Parameters:**

<Nrrc> integer

Range: 0 to max
Increment: 1
*RST: 0

**Example:** BB:EUTR:UL:UE2:REFS:SRS:NRRC 10
sets the SRS frequency domain position

**Manual operation:** See "Freq. Domain Position n_RRC" on page 246

## 9.21 Realtime Feedback

The Realtime Feedback Configuration is enabled only for UE1 in instruments equipped with the option R&S SMW-K69.

[:SOURce<hw>]:BB:EUTRa:UL:RTFB:AACK....532
[:SOURce<hw>]:BB:EUTRa:UL:RTFB:ACKDefinition....532
[:SOURce<hw>]:BB:EUTRa:UL:RTFB:ADUDelay....533
[:SOURce<hw>]:BB:EUTRa:UL:RTFB:BBSelector....533
[:SOURce<hw>]:BB:EUTRa:UL:RTFB:BEINsertion....534
[:SOURce<hw>]:BB:EUTRa:UL:RTFB:BERate....534
[:SOURce<hw>]:BB:EUTRa:UL:RTFB:CONNector....534
[:SOURce<hw>]:BB:EUTRa:UL:RTFB:DMODe....535
[:SOURce<hw>]:BB:EUTRa:UL:RTFB:ITADvance....535
[:SOURce<hw>]:BB:EUTRa:UL:RTFB:MAXTrans....535
[:SOURce<hw>]:BB:EUTRa:UL:RTFB:MODE....536
[:SOURce<hw>]:BB:EUTRa:UL:RTFB:RVSequence....536
[:SOURce<hw>]:BB:EUTRa:UL:RTFB:SERate....537

**[:SOURce<hw>]:BB:EUTRa:UL:RTFB:AACK** <AssumeACK>

If this parameter is enabled, the signal generator will not use any external HARQ feedback from the device under test for its HARQ processes until an ACK command is received the first time.

For detailed description, refer to "Assume ACK until first received ACK command" on page 232.

**Parameters:**

<AssumeACK> 0 | 1 | OFF | ON
*RST: OFF

**Options:** R&S SMW-K69

**Manual operation:** See "Assume ACK until first received ACK command" on page 232

**[:SOURce<hw>]:BB:EUTRa:UL:RTFB:ACKDefinition** <AckDefinition>

(Binary ACK/NACK mode only)

Determines whether a high or a low binary level on the feedback line connector represents an ACK.

**Parameters:**

<AckDefinition> HIGH | LOW

*RST: HIGH

**Example:**
```
BB:EUTR:UL:RTFB:MODE BAN
BB:EUTR:UL:RTFB:ACKD HIGH
```

**Options:** R&S SMW-K69

**Manual operation:** See "ACK Definition" on page 233

---

**[:SOURce<hw>]:BB:EUTRa:UL:RTFB:ADUDelay** <AddUserDelay>

Determines the point in time when the feedback can be sent to the instrument.

| Mode | Value Range | |
|---|---|---|
| **Binary** | 3GPP Distance Mode | -1.00 .. 2.99 subframes |
| | Direct Response Distance Mode | +1.00 .. 6.99 subframes |
| **Serial and Serial 3x8** | - | -1.00 .. 1.99 subframes |

**Parameters:**

<AddUserDelay> float

Range: -1.00 to 6.99
Increment: 0.01
*RST: 0
Default unit: subframes

**Example:**
```
BB:EUTR:UL:RTFB:ADUD 1
```
sets the additional user delay

**Options:** R&S SMW-K69

**Manual operation:** See "Additional User Delay" on page 233

---

**[:SOURce<hw>]:BB:EUTRa:UL:RTFB:BBSelector** <BasebandSelect>

(Serial mode only)

Needed for multiplexing serial commands for different baseband units to one feedback line. If the selector n is configured in the GUI for a specific baseband unit, the baseband unit will listen only to serial commands containing the selector n.

**Parameters:**

<BasebandSelect> integer

Range: 0 to 3
Increment: 1
*RST: 0 (for Baseband A); 1 (for Baseband B)

**Example:** `BB:EUTR:UL:RTFB:MODE SER`
enables realtime feedback on a serial line
`BB:EUTR:UL:RTFB:BBS 1`
sets the baseband selector

**Options:** R&S SMW-K69

**Manual operation:** See "Baseband Selector" on page 233

---

**[:SOURce<hw>]:BB:EUTRa:UL:RTFB:BEINsertion** <BlockErrInsert>

Enables/disables the statistical insertion of block errors into PUSCH packets.

The block error insertion can be enabled for a single HARQ process or for all processes.

In the single HARQ process case, the used process is always the one that corresponds to the first activated PUSCH.

**Parameters:**
<BlockErrInsert> OFF | FPRocess | APRocesses
*RST: OFF

**Example:** `BB:EUTR:UL:RTFB:BEIN FPR`
enables block error insertion for the first process

**Options:** R&S SMW-K69

**Manual operation:** See "Block Error Insertion" on page 234

---

**[:SOURce<hw>]:BB:EUTRa:UL:RTFB:BERate** <BlockErrRate>

Block error rate for the statistical insertion of block errors.

**Parameters:**
<BlockErrRate> float
Range: 0.0001 to 1.0
Increment: 0.0001
*RST: 0.0001

**Example:** `BB:EUTR:UL:RTFB:BER 0.5`
sets the block error rate

**Options:** R&S SMW-K69

**Manual operation:** See "Block Error Rate" on page 234

---

**[:SOURce<hw>]:BB:EUTRa:UL:RTFB:CONNector** <Connector>

Determines the feedback line connector.

**Parameters:**
<Connector> LOCal | GLOBal
*RST: LOCal

**Example:** Enabling the feedback signal at the local TM3 connector of Baseband A.
```
SOURce1:INPut:TM3:DIRection INPut
SOURce1:INPut:TM3:SIGNal FEEDback
SOURce1:BB:EUTRa:UL:RTFB:CONNector LOCal
```

**Example:** Enabling the feedback signal at the global USER6 connector.
```
SOURce:INPut:USER6:DIRection INPut
SOURce:INPut:USER6:SIGNal FEEDback
SOURce1:BB:EUTRa:UL:RTFB:CONNector GLOBal
```

**Options:** R&S SMW-K69

**Manual operation:** See "Connector" on page 233

---

**[:SOURce<hw>]:BB:EUTRa:UL:RTFB:DMODe** <DistanceMode>

Detemines how the number of the uplink subframe is calculated, in which the signaled feedback has the desired effect.

**Parameters:**

<DistanceMode> STD | DIRect

*RST: STD

**Example:**
```
BB:EUTR:UL:RTFB:DMOD DIR
```
sets direct distance mode

**Options:** R&S SMW-K69

**Manual operation:** See "Distance Mode" on page 233

---

**[:SOURce<hw>]:BB:EUTRa:UL:RTFB:ITADvance** <InitTimAdvance>

The initial timing advance of the uplink signal (at the output of the instrument's baseband unit) in units of 16 $T_S$.

**Parameters:**

<InitTimAdvance> integer

Range: 0 x 16 Ts to 1282 x 16 Ts
Increment: 1 x 16 Ts
*RST: 0 x 16 Ts

**Example:**
```
BB:EUTR:UL:RTFB:ITAD 16
```
sets the inital timing advance

**Options:** R&S SMW-K69

**Manual operation:** See "Realtime Feedback Mode" on page 231

---

**[:SOURce<hw>]:BB:EUTRa:UL:RTFB:MAXTrans** <MaxTransmission>

After this maximum number of transmissions (incl. first transmission), the first redundancy version of the redundancy version sequence is used even in case of NACK.

**Parameters:**

<MaxTransmission> integer

Range: 1 to 20
Increment: 1
*RST: 4

**Example:** `BB:EUTR:UL:RTFB:MAXT 5`
sets the maximum number of transmissions

**Options:** R&S SMW-K69

**Manual operation:** See "Max. Number of Transmissions" on page 232

---

**[:SOURce<hw>]:BB:EUTRa:UL:RTFB:MODE** <Mode>

Enables realtime feedback and determines the mode (binary or serial).

**Parameters:**

<Mode> OFF | BAN | SERial | S3X8

*RST: OFF

**Example:** `BB:EUTR:UL:RTFB:MODE SER`
enables realtime feedback on a serial line

**Options:** R&S SMW-K69

---

**[:SOURce<hw>]:BB:EUTRa:UL:RTFB:RVSequence** <RedVersSequence>

Determines the sequence of redundancy versions for the individual HARQ processes.

Unless otherwise requested by serial feedback commands, the first value in the sequence of redundancy versions is used each time an ACK is received or for the very first transmission of a process.

The sequence of redundancy versions is read out cyclically, i.e. whenever a NACK is received and a retransmission is requested, the next redundancy version in the sequence is used.

The first value in the sequence is used again even in case a NACK is received, if the maximum number of transmissions (`BB:EUTR:UL:RTFB:MAXT`) in a process was reached.

**Parameters:**

<RedVersSequence> string

**Example:** `BB:EUTR:UL:RTFB:RVS '0,2,3,1'`
sets the redundancy version sequence

**Options:** R&S SMW-K69

**Manual operation:** See "Redundancy Version Sequence" on page 232

**[:SOURce<hw>]:BB:EUTRa:UL:RTFB:SERate** <SerialRate>

(Serial mode only)

Determines the bit rate of the serial transmission.

**Parameters:**

<SerialRate> SR115_2K | SR1_92M | SR1_6M

*RST: SR115_2K

**Example:** `BB:EUTR:UL:RTFB:MODE SER`
enables realtime feedback on a serial line
`BB:EUTR:UL:RTFB:SER SR115_2K`
sets the serial rate

**Options:** R&S SMW-K69

**Manual operation:** See "Serial Rate" on page 234

## 9.22 LTE Logfiles Generation

Logfile Generation requires an additional SW option and is enabled only for instruments equipped with R&S SMW-K81.

**Example: Logfiles Generation**

```
SOUR:BB:EUTR:LOGG:OUTP '/var/user/temp/logfiles'
SOUR:BB:EUTR:LOGG:LFP '201008Log'
SOUR:BB:EUTR:LOGG:DL:EDL ON
SOUR:BB:EUTR:LOGG:DL:PBCH ON
SOUR:BB:EUTR:LOGG:DL:LOGP9 ON
SOUR:BB:EUTR:LOGG:STAT ON
SOUR:BB:EUTR:STAT ON
```

**[:SOURce<hw>]:BB:EUTRa:LOGGen:STATe** <LoggingState>

Enables/disables logfile generation.

**Parameters:**

<LoggingState> 0 | 1 | OFF | ON

*RST: OFF

**Example:** example "Logfiles Generation" on page 537

**Options:** R&S SMW-K81

**Manual operation:** See "Logging State" on page 103

**[:SOURce<hw>]:BB:EUTRa:LOGGen:OUTPut** <OutputPath>

Selects the network directory the logged files are stored in.

**Parameters:**
<OutputPath> string
*RST: /var/user/log

**Example:** example "Logfiles Generation" on page 537

**Options:** R&S SMW-K81

**Manual operation:** See "Output Path" on page 104

**[:SOURce<hw>]:BB:EUTRa:LOGGen:LFP** <Preamble>

An optional preamble may be added to the file name. Refer to chapter 7.8.2.1, "File Names", on page 93 for a description of the file naming convention used.

**Parameters:**
<Preamble> string
*RST: K55Log

**Example:** example "Logfiles Generation" on page 537

**Options:** R&S SMW-K81

**Manual operation:** See "Logging Files Preamble" on page 104

**[:SOURce<hw>]:BB:EUTRa:LOGGen:DL:EDLogging** <ExtDciLog>
**[:SOURce<hw>]:BB:EUTRa:LOGGen:UL:EULogging** <ExtUciLog>

Enables the generation of a logfile with extended information regarding the DCI/UCI mapping.

**Parameters:**
<ExtUciLog> 0 | 1 | OFF | ON
*RST: OFF

**Example:** example "Logfiles Generation" on page 537

**Options:** R&S SMW-K81

**Manual operation:** See "Extended DCI/UCI Logging" on page 104

**[:SOURce<hw>]:BB:EUTRa:LOGGen:DL:EALL**
**[:SOURce<hw>]:BB:EUTRa:LOGGen:UL:EALL**
**[:SOURce<hw>]:BB:EUTRa:LOGGen:DL:DALL**
**[:SOURce<hw>]:BB:EUTRa:LOGGen:UL:DALL**

Enables/disables all logging points.

**Example:** example "Logfiles Generation" on page 537

**Options:** R&S SMW-K81

**Manual operation:** See "Enable/Disable All" on page 104

---

**[:SOURce<hw>]:BB:EUTRa:LOGGen:DL:LOGPoint<ch0>** <LogPointState>
**[:SOURce<hw>]:BB:EUTRa:LOGGen:UL:LOGPoint<ch0>** <LogPointState>

Enables/disables one particular logging point.

Refer to chapter 7.8.1, "Signal Processing Chains and Logging Points", on page 90 for description on the available logging points.

**Parameters:**
<LogPointState> 0 | 1 | OFF | ON
*RST: OFF

**Example:** example "Logfiles Generation" on page 537

**Options:** R&S SMW-K81

**Manual operation:** See "Logging Point" on page 104

---

**[:SOURce<hw>]:BB:EUTRa:LOGGen:DL:ENCC** <EnccLogState>
**[:SOURce<hw>]:BB:EUTRa:LOGGen:DL:PBCH** <PbchLogState>
**[:SOURce<hw>]:BB:EUTRa:LOGGen:DL:PDSCh** <PdschLogState>
**[:SOURce<hw>]:BB:EUTRa:LOGGen:DL:PMCH** <State>
**[:SOURce<hw>]:BB:EUTRa:LOGGen:UL:PUSCh** <PuschLogState>

Enables the channel for that logfiles are generated.

**Parameters:**
<PuschLogState> 0 | 1 | OFF | ON
*RST: ON

**Example:** example "Logfiles Generation" on page 537

**Options:** R&S SMW-K81

**Manual operation:** See "Physical Channels" on page 104

## 9.23 Test Case Wizard Remote-Control Commands

The signal generator gives you the opportunity to generate predefined settings which enable tests on base stations in conformance with the 3G standard EUTRA/LTE. It offers a selection of predefined settings according to Test Cases in TS 36.141. The settings take effect only after execution of command
`[SOURce<hw>:]BB:EUTRa:TCW:APPLysettings`.

[:SOURce<hw>]:BB:EUTRa:TCW:APPLysettings....541
[:SOURce<hw>]:BB:EUTRa:TCW:AWGN:PLevel?....541
[:SOURce<hw>]:BB:EUTRa:TCW:FA:FRALlocation....542
[:SOURce<hw>]:BB:EUTRa:TCW:FA:RBALlocation....542
[:SOURce<hw>]:BB:EUTRa:TCW:GS:RELease....542
[:SOURce<hw>]:BB:EUTRa:TCW:GS:ANTSubset....542

[:SOURce<hw>]:BB:EUTRa:TCW:GS:GENSignals....542
[:SOURce<hw>]:BB:EUTRa:TCW:GS:INSTsetup....542
[:SOURce<hw>]:BB:EUTRa:TCW:GS:MODE....543
[:SOURce<hw>]:BB:EUTRa:TCW:GS:MARKerconfig....543
[:SOURce<hw>]:BB:EUTRa:TCW:GS:BSCLass....543
[:SOURce<hw>]:BB:EUTRa:TCW:GS:RXANtennas....544
[:SOURce<hw>]:BB:EUTRa:TCW:GS:TXANtennas....544
[:SOURce<hw>]:BB:EUTRa:TCW:GS:SIGRout....544
[:SOURce<hw>]:BB:EUTRa:TCW:GS:TRIGgerconfig....544
[:SOURce<hw>]:BB:EUTRa:TCW:IS:CHBW?....545
[:SOURce<hw>]:BB:EUTRa:TCW:IS:CLID....545
[:SOURce<hw>]:BB:EUTRa:TCW:IS:DUPLex....545
[:SOURce<hw>]:BB:EUTRa:TCW:IS:FRSHift....545
[:SOURce<hw>]:BB:EUTRa:TCW:IS2:IFTYpe?....546
[:SOURce<hw>]:BB:EUTRa:TCW:IS:IFTYpe....546
[:SOURce<hw>]:BB:EUTRa:TCW:IS:NRBlock?....546
[:SOURce<hw>]:BB:EUTRa:TCW:IS:NTAOffset....546
[:SOURce<hw>]:BB:EUTRa:TCW:IS:OCEdge....546
[:SOURce<hw>]:BB:EUTRa:TCW:IS:OVRB?....547
[:SOURce<hw>]:BB:EUTRa:TCW:IS2:PLevel?....547
[:SOURce<hw>]:BB:EUTRa:TCW:IS3:PLevel?....547
[:SOURce<hw>]:BB:EUTRa:TCW:IS:PLevel?....547
[:SOURce<hw>]:BB:EUTRa:TCW:IS:RBCFrequency....547
[:SOURce<hw>]:BB:EUTRa:TCW:IS2:RFFRequency?....547
[:SOURce<hw>]:BB:EUTRa:TCW:IS:RFFRequency....547
[:SOURce<hw>]:BB:EUTRa:TCW:IS:TDDConfig....548
[:SOURce<hw>]:BB:EUTRa:TCW:IS:TMODel?....548
[:SOURce<hw>]:BB:EUTRa:TCW:IS:TREQuire....548
[:SOURce<hw>]:BB:EUTRa:TCW:IS:UEID....548
[:SOURce<hw>]:BB:EUTRa:TCW:MUE:TSRS....548
[:SOURce<hw>]:BB:EUTRa:TCW:SUE:TSRS....548
[:SOURce<hw>]:BB:EUTRa:TCW:RTF:ACKDefinition....549
[:SOURce<hw>]:BB:EUTRa:TCW:RTF:AUSDelay....549
[:SOURce<hw>]:BB:EUTRa:TCW:RTF:BBSMue....549
[:SOURce<hw>]:BB:EUTRa:TCW:RTF:BBSSue....549
[:SOURce<hw>]:BB:EUTRa:TCW:RTF:BBSelector....549
[:SOURce<hw>]:BB:EUTRa:TCW:RTF:CONMue....549
[:SOURce<hw>]:BB:EUTRa:TCW:RTF:CONSue....549
[:SOURce<hw>]:BB:EUTRa:TCW:RTF:CONNector....549
[:SOURce<hw>]:BB:EUTRa:TCW:RTF:MODE....550
[:SOURce<hw>]:BB:EUTRa:TCW:RTF:SERRate....550
[:SOURce<hw>]:BB:EUTRa:TCW:TC....550
[:SOURce<hw>]:BB:EUTRa:TCW:WS:ACPucch....551
[:SOURce<hw>]:BB:EUTRa:TCW:WS:ANBits....551
[:SOURce<hw>]:BB:EUTRa:TCW:WS:ANPattern?....551
[:SOURce<hw>]:BB:EUTRa:TCW:WS:BFormat....551
[:SOURce<hw>]:BB:EUTRa:TCW:WS:CHBW....551
[:SOURce<hw>]:BB:EUTRa:TCW:WS:CLID....552
[:SOURce<hw>]:BB:EUTRa:TCW:WS:CYCPrefix....552
[:SOURce<hw>]:BB:EUTRa:TCW:WS:CQIPattern:PORT<ch0>....552

[:SOURce<hw>]:BB:EUTRa:TCW:WS:DUPLex....552
[:SOURce<hw>]:BB:EUTRa:TCW:WS:FMThroughput....552
[:SOURce<hw>]:BB:EUTRa:TCW:WS:FRC....553
[:SOURce<hw>]:BB:EUTRa:TCW:WS:FROffset....553
[:SOURce<hw>]:BB:EUTRa:TCW:WS:HSMode....553
[:SOURce<hw>]:BB:EUTRa:TCW:WS:NTAOffset....553
[:SOURce<hw>]:BB:EUTRa:TCW:IS:ORTCover?....553
[:SOURce<hw>]:BB:EUTRa:TCW:IS2:ORTCover?....553
[:SOURce<hw>]:BB:EUTRa:TCW:IS3:ORTCover?....553
[:SOURce<hw>]:BB:EUTRa:TCW:WS:ORTCover[:PORT<ch0>]?....553
[:SOURce<hw>]:BB:EUTRa:TCW:WS:ORTCover?....553
[:SOURce<hw>]:BB:EUTRa:TCW:WS:OUPLevel....554
[:SOURce<hw>]:BB:EUTRa:TCW:MUE:OVRB....554
[:SOURce<hw>]:BB:EUTRa:TCW:SUE:OVRB....554
[:SOURce<hw>]:BB:EUTRa:TCW:WS:OVRB....554
[:SOURce<hw>]:BB:EUTRa:TCW:WS:PLevel?....554
[:SOURce<hw>]:BB:EUTRa:TCW:WS:PLPC?....554
[:SOURce<hw>]:BB:EUTRa:TCW:WS:PLPS?....555
[:SOURce<hw>]:BB:EUTRa:TCW:IS:PRCOndition?....555
[:SOURce<hw>]:BB:EUTRa:TCW:IS2:PRCOndition?....555
[:SOURce<hw>]:BB:EUTRa:TCW:IS3:PRCOndition?....555
[:SOURce<hw>]:BB:EUTRa:TCW:WS:PROCondition....555
[:SOURce<hw>]:BB:EUTRa:TCW:WS:RFFRequency....555
[:SOURce<hw>]:BB:EUTRa:TCW:WS:SPSFrame....555
[:SOURce<hw>]:BB:EUTRa:TCW:WS:TDDConfig....556
[:SOURce<hw>]:BB:EUTRa:TCW:WS:TIOBase?....556
[:SOURce<hw>]:BB:EUTRa:TCW:MUE:UEID....556
[:SOURce<hw>]:BB:EUTRa:TCW:SUE:UEID....556
[:SOURce<hw>]:BB:EUTRa:TCW:WS:UEID....556

### [:SOURce<hw>]:BB:EUTRa:TCW:APPLysettings

Activates the current settings of the test case wizard.

**Note:** The settings of the selected test case becomes active only after executing this command.

**Usage:** Event

**Manual operation:** See "Apply Settings" on page 289

### [:SOURce<hw>]:BB:EUTRa:TCW:AWGN:PLevel?

Queries the AWGN power level.

**Return values:**
<PowerLevel> string

**Usage:** Query only

**Manual operation:** See "AWGN Configuration" on page 308

**[:SOURce<hw>]:BB:EUTRa:TCW:FA:FRALlocation** <FrequencyAlloc>
**[:SOURce<hw>]:BB:EUTRa:TCW:FA:RBALlocation** <ResBlockAlloc>

Determines the frequency position of the wanted and interfering signal.

**Parameters:**
<ResBlockAlloc> HIGHer | LOWer

**Manual operation:** See "Frequency Allocation of the Interfering signal" on page 286

**[:SOURce<hw>]:BB:EUTRa:TCW:GS:RELease** <Release>

Sets the 3GPP test specification used as a guide line for the test cases.

**Parameters:**
<Release> REL8 | REL9 | REL10 | REL11

**Manual operation:** See "Release" on page 283

**[:SOURce<hw>]:BB:EUTRa:TCW:GS:ANTSubset** <AntennaSubset>

Enabled for test setups with four Rx antennas

Determines the signal of which antenna couple, Antenna 1 and 2 (`AS12`) or Antenna 3 and 4 (`AS34`), is generated by the instrument.

**Parameters:**
<AntennaSubset> AS34 | AS12 | ALL

**Manual operation:** See "Antenna Subset" on page 286

**[:SOURce<hw>]:BB:EUTRa:TCW:GS:GENSignals** <GeneratedSignal>

Determines the signal generated by the instrument.

**Parameters:**
<GeneratedSignal> WSIF1AWGN | IF23 | ALL

**WSIF1AWGN**
Wanted Signal, Interfer 1 and AWGN only; required in test setup with two instrument

**WSIF1AWGN**
Interferes 2 and 3 only; required in test setup with two instrument

**ALL**
the instrument generates all required signals

**Manual operation:** See "Generated Signal" on page 353

**[:SOURce<hw>]:BB:EUTRa:TCW:GS:INSTsetup** <InstrumentSetup>

Determines whether one or both paths are used.

**Parameters:**
<InstrumentSetup> 2PATH | 1PATH

**Manual operation:** See "Instrument Setup" on page 285

---

**[:SOURce<hw>]:BB:EUTRa:TCW:GS:MODE** <Mode>

Determines the measurements type, Pfa or Pd, the signal is generated for, see "Mode" on page 366.

**Parameters:**
<Mode> DRATe | FDRate | ADRate

**FDRate**
False Detection Rate (Pfa)

**DRATe**
Detection Rate (Pd)

**ADRate**
Alternating Pd and Pfa

*RST: DRATe

**Example:** `SOUR:BB:EUTR:TCW:GS:MODE ADRate`

**Manual operation:** See "Mode" on page 366

---

**[:SOURce<hw>]:BB:EUTRa:TCW:GS:MARKerconfig** <MarkerConfig>

Selects the marker configuration. The marker can be used to synchronize the measuring equipment to the signal generator.

**Parameters:**
<MarkerConfig> UNCHanged | FRAMe

**FRAMe**
The marker settings are customized for the selected test case. "Radio Frame Start" markers are output; the marker delays are set equal to zero.

**UNCHanged**
The current marker settings of the signal generator are retained unchanged.

**Manual operation:** See "Marker Configuration" on page 285

---

**[:SOURce<hw>]:BB:EUTRa:TCW:GS:BSCLass** <BsClass>

Sets the base station class.

**Parameters:**
<BsClass> WIDE | LOCal | HOME | MEDium

*RST: WIDE

**Example:**
```
SOURce1:BB:EUTRa:TCW:GS:RELease REL10
SOURce1:BB:EUTRa:TCW:TC TS36141_TC72
SOURce1:BB:EUTRa:TCW:GS:BSCLass LOCal
SOURce1:BB:EUTRa:TCW:WS:PLevel?
```
Response: `"-98.10 dBm"`

**Manual operation:** See "Base Station Class" on page 283

---

**[:SOURce<hw>]:BB:EUTRa:TCW:GS:RXANtennas** <NumOfRXAntennas>

For performance requirement tests, determines the number of the Rx antennas.

**Parameters:**
<NumOfRXAntennas>ANT4 | ANT2 | ANT1

**Manual operation:** See "Number of Rx Antennas" on page 284

---

**[:SOURce<hw>]:BB:EUTRa:TCW:GS:TXANtennas** <NumOfTxAntennas>

For performance requirement tests, determines the number of the Tx antennas.

**Parameters:**
<NumOfTxAntennas> ANT1 | ANT2
*RST: ANT1

**Example:**
```
SOURce1:BB:EUTRa:TCW:GS:TXANtennas ANT1
```

**Manual operation:** See "Number of Tx Antennas" on page 284

---

**[:SOURce<hw>]:BB:EUTRa:TCW:GS:SIGRout** <SignalRouting>

Selects the signal routing for baseband A signal which in most test cases represents the wanted signal.

**Parameters:**
<SignalRouting> PORTB | PORTA

**Manual operation:** See "Signal Routing" on page 285

---

**[:SOURce<hw>]:BB:EUTRa:TCW:GS:TRIGgerconfig** <TriggerConfig>

Selects the trigger configuration. The trigger is used to synchronize the signal generator to the other equipment.

**Parameters:**

<TriggerConfig> UNCHanged | AAUTo

**UNCHanged**
The current trigger settings of the signal generator are retained unchanged.

**AAUTo**
The trigger settings are customized for the selected test case. The trigger setting "Armed Auto" with external trigger source "External Trigger 1" is used; the trigger delay is set equal to zero. Thus, the base station frame timing is able to synchronize the signal generator by a periodic trigger.

**Manual operation:** See "Trigger Configuration" on page 284

---

**[:SOURce<hw>]:BB:EUTRa:TCW:IS:CHBW?**

Queries the channel bandwidth of the interfering signal.

**Return values:**

<ChanBandwidth> BW20_00 | BW10_00 | BW5_00 | BW3_00 | BW1_40 | BW15_00

**Usage:** Query only

**Manual operation:** See "Interfering Signal" on page 295

---

**[:SOURce<hw>]:BB:EUTRa:TCW:IS:CLID** <CellID>

Sets the Cell ID for the interfering signal.

**Parameters:**

<CellID> integer

Range: 0 to 503
Increment: 1
*RST: 1

**Manual operation:** See "Cell ID" on page 303

---

**[:SOURce<hw>]:BB:EUTRa:TCW:IS:DUPLex** <Duplex>

Selects whether TDD or FDD duplexing mode is used.

**Parameters:**

<Duplex> TDD | FDD

**Manual operation:** See "Interfering Signal" on page 295

---

**[:SOURce<hw>]:BB:EUTRa:TCW:IS:FRSHift** <FrequencyShift>

Sets the value of hte prameter Frequency Shift m.

**Parameters:**
<FrequencyShift> FS24 | FS19 | FS14 | FS13 | FS10 | FS9 | FS7 | FS5 | FS4 | FS3 | FS2 | FS1 | FS0

**Manual operation:** See "Frequency Shift m" on page 303

---

**[:SOURce<hw>]:BB:EUTRa:TCW:IS2:IFTYpe?**
**[:SOURce<hw>]:BB:EUTRa:TCW:IS:IFTYpe** <InterfererType>

Selects the type of the interfering signal:

- For **Blocking** tests, the interfering signal can be an in-band EUTRA/LTE signal (`EUTra`) or out-of-band CW signal (`CW`).
- For **Receiver Intermodulation** tests, the first interfering signal can be an EUTRA/LTE signal (`EUTra`) or narrow-band EUTRA signal (`NEUTra`).
  The second interfering signal is always a CW signal (`CW`).

**Parameters:**
<InterfererType> NEUTra | EUTra | CW

**Manual operation:** See "Interferer Type" on page 301

---

**[:SOURce<hw>]:BB:EUTRa:TCW:IS:NRBlock?**

Queries the number of RBs used by the LTE interfering signal.

**Return values:**
<NumResBlock> integer
Range: 3 to 25
Increment: 1
*RST: 3

**Usage:** Query only

**Manual operation:** See "Number of Resource Blocks" on page 303

---

**[:SOURce<hw>]:BB:EUTRa:TCW:IS:NTAOffset** <SigAdvNTAoffset>

Sets the parameter $N_{TAoffset}$.

**Parameters:**
<SigAdvNTAoffset> NTA624 | NTA0

**Manual operation:** See "Signal Advance N_TA_offset" on page 302

---

**[:SOURce<hw>]:BB:EUTRa:TCW:IS:OCEdge** <OffsChannelEdge>

Defines the offset of the interfering signal center frequency relative to edge of the wanted channel bandwidth.

**Parameters:**
<OffsChannelEdge> OCE12_5 | OCE7_5 | OCE2_5

**Manual operation:** See "Interfering Signal" on page 295

---

**[:SOURce<hw>]:BB:EUTRa:TCW:IS:OVRB?**

Sets the offset VRB.

**Return values:**
<OffsetVRB> integer

Range: 0 to 75
Increment: 1
*RST: 0

**Usage:** Query only

**Manual operation:** See "Offset VRB" on page 303

---

**[:SOURce<hw>]:BB:EUTRa:TCW:IS2:PLevel?**
**[:SOURce<hw>]:BB:EUTRa:TCW:IS3:PLevel?**
**[:SOURce<hw>]:BB:EUTRa:TCW:IS:PLevel?**

Queries the power level of the interfering signal.

**Return values:**
<PowerLevel> string

**Usage:** Query only

**Manual operation:** See "Interfering Signal" on page 295

---

**[:SOURce<hw>]:BB:EUTRa:TCW:IS:RBCFrequency** <RBlockCentFreq>

Queries the center frequency of the single resource block interfering signal.

**Parameters:**
<RBlockCentFreq> float

Range: 100e+03 to 6e+09
Increment: 1
*RST: 1.95e+09

**Manual operation:** See "Interfering RB Center Frequency" on page 304

---

**[:SOURce<hw>]:BB:EUTRa:TCW:IS2:RFFRequency?**
**[:SOURce<hw>]:BB:EUTRa:TCW:IS:RFFRequency** <RfFrequency>

Queries the center frequency of the interfering signal.

**Parameters:**
<RfFrequency> float

Range: 100e+03 to 6e+09
Increment: 1
*RST: 1.95e+09

**Manual operation:** See "Interfering Signal" on page 295

**[:SOURce<hw>]:BB:EUTRa:TCW:IS:TDDConfig** <TddConfig>

For TDD mode, selects the UL/DL Configuration number.

**Parameters:**
<TddConfig> integer
Range: 0 to 6
Increment: 1
*RST: 0

**Manual operation:** See "TDD UL/DL Configuration" on page 302

**[:SOURce<hw>]:BB:EUTRa:TCW:IS:TMODel?**

Queries the test model. The interfering signal is generated according to E-TM1.1 test model.

**Return values:**
<TestModel> TM1_1

**Usage:** Query only

**Manual operation:** See "Interfering Signal" on page 295

**[:SOURce<hw>]:BB:EUTRa:TCW:IS:TREQuire** <TestRequire>

Selects whether the standard out-of-band blocking requirements test is performed (`BLPE`) or the optional blocking scenario, when the BS is co-located with another BS in a different operating band (`COBS`).

**Parameters:**
<TestRequire> COBS | BLPE

**Manual operation:** See "Test Requirement" on page 320

**[:SOURce<hw>]:BB:EUTRa:TCW:IS:UEID** <UE_ID_nRNTI>

Sets the UE ID/n_RNTI for the interfering signal.

**Parameters:**
<UE_ID_nRNTI> integer
Range: 0 to 65535
Increment: 1
*RST: 1

**Manual operation:** See "UE ID/n_RNTI" on page 303

**[:SOURce<hw>]:BB:EUTRa:TCW:MUE:TSRS** <TransmitSRS>
**[:SOURce<hw>]:BB:EUTRa:TCW:SUE:TSRS** <TransmitSRS>

Enables/disables the transmission of the SRS.

The SRS transmission is optional for this test case.

**Parameters:**
<TransmitSRS> 0 | 1 | OFF | ON

**Manual operation:** See "Transmit SRS" on page 337

---

**[:SOURce<hw>]:BB:EUTRa:TCW:RTF:ACKDefinition** <AckDefinition>

Determines whether a high or a low binary level on the feedback line connector represents an ACK.

**Parameters:**
<AckDefinition> LOW | HIGH

**Manual operation:** See "Realtime Feedback Configuration" on page 327

---

**[:SOURce<hw>]:BB:EUTRa:TCW:RTF:AUSDelay** <AddUserDelay>

Determines the point in time when the feedback can be sent to the instrument.

**Parameters:**
<AddUserDelay> float

Range: -1 to +2.99
Increment: 0.01
*RST: 0

**Manual operation:** See "Realtime Feedback Configuration" on page 327

---

**[:SOURce<hw>]:BB:EUTRa:TCW:RTF:BBSMue** <BBSelectMovUE>
**[:SOURce<hw>]:BB:EUTRa:TCW:RTF:BBSSue** <BBSelectStatUE>
**[:SOURce<hw>]:BB:EUTRa:TCW:RTF:BBSelector** <BBSelector>

This parameter is required for multiplexing serial commands for different baseband units to one feedback line. If the selector n is configured in the GUI for a specific baseband unit, the baseband unit will listen only to serial commands containing the selector n.

**Parameters:**
<BBSelector> integer

Range: 0 to 3
Increment: 1
*RST: 0

**Manual operation:** See "Realtime Feedback Configuration" on page 327

---

**[:SOURce<hw>]:BB:EUTRa:TCW:RTF:CONMue** <ConnectorMovUE>
**[:SOURce<hw>]:BB:EUTRa:TCW:RTF:CONSue** <ConnectorStatUE>
**[:SOURce<hw>]:BB:EUTRa:TCW:RTF:CONNector** <Connector>

Determines the feedback line connector.

**Parameters:**
<Connector> NOFB | LOCal | GLOBal

**Manual operation:** See "Realtime Feedback Configuration" on page 327

---

**[:SOURce<hw>]:BB:EUTRa:TCW:RTF:MODE** <Mode>

Determines the feedback mode.

**Parameters:**

<Mode> SER3X8 | SER | BIN

**BIN**
Binary ACK/NACK
The ACK/NACK feedback is implemented as low/high voltage level on the feedback line connector.

**SER**
Serial
ACK/NACK Feedback and Timing Adjustments Feedback are implemented by means of a serial protocol.

**SER3X8**
Serial 3x8
ACK/NACK Feedback and Timing Adjustments Feedback are implemented by means of a serial commands, consisting of three serial packets.

**Manual operation:** See "Realtime Feedback Configuration" on page 327

---

**[:SOURce<hw>]:BB:EUTRa:TCW:RTF:SERRate** <SerialRate>

Sets the bit rate of the serial transmission. Possible rates are 115.2 kbps, 1.6 Mbps and 1.92 Mbps.

**Parameters:**

<SerialRate> SR1_92M | SR1_6M | SR115_2K

**Manual operation:** See "Realtime Feedback Configuration" on page 327

---

**[:SOURce<hw>]:BB:EUTRa:TCW:TC** <TestCase>

Selects the test case.

**Parameters:**

<TestCase> TS36141_TC67 | TS36141_TC72 | TS36141_TC73 | TS36141_TC74 | TS36141_TC75A | TS36141_TC75B | TS36141_TC76 | TS36141_TC78 | TS36141_TC821 | TS36141_TC822 | TS36141_TC823 | TS36141_TC824 | TS36141_TC831 | TS36141_TC832 | TS36141_TC833 | TS36141_TC841 | TS36141_TC839 | TS36141_TC834 | TS36141_TC835 | TS36141_TC836

**Manual operation:** See "Test Case" on page 284

**[:SOURce<hw>]:BB:EUTRa:TCW:WS:ACPucch** <AddConfigPUCCH>

Enables the optional transmission of PUCCH format 2.

**Parameters:**
<AddConfigPUCCH> 0 | 1 | OFF | ON

**Manual operation:** See "Additionally Configure PUCCH" on page 344

**[:SOURce<hw>]:BB:EUTRa:TCW:WS:ANBits** <AckNackBits>

In performace requirement test cases, sets the number of encoded ACK/NACK bits per subframe.

**Parameters:**
<AckNackBits> ANB4 | ANB16

**Example:**
```
SOURce1:BB:EUTRa:TCW:TC TS36141_TC836
SOURce1:BB:EUTRa:TCW:WS:ANBits?
Response: ANB16
```

**Manual operation:** See "Number of ACK/NACK bits" on page 359

**[:SOURce<hw>]:BB:EUTRa:TCW:WS:ANPattern?**

In performace requirement test cases, queries the ACK/NACK + SR pattern bits.

**Return values:**
<AckNackPattern> integer

**Example:**
```
SOURce1:BB:EUTRa:TCW:TC TS36141_TC836
SOURce1:BB:EUTRa:TCW:WS:ANPattern?
Response: "0000000000000000"
```

**Usage:** Query only

**Manual operation:** See "ACK/NACK + SR Pattern" on page 359

**[:SOURce<hw>]:BB:EUTRa:TCW:WS:BFormat** <BurstFormat>

Sets the burst format.

**Parameters:**
<BurstFormat> BF4 | BF3 | BF2 | BF1 | BF0

**Manual operation:** See "Burst Format" on page 367

**[:SOURce<hw>]:BB:EUTRa:TCW:WS:CHBW** <ChanBandwidth>

Selects the channel bandwidth.

**Parameters:**
<ChanBandwidth> BW20_00 | BW10_00 | BW5_00 | BW3_00 | BW1_40 | BW15_00

**Manual operation:** See "Channel Bandwidth" on page 288

---

**[:SOURce<hw>]:BB:EUTRa:TCW:WS:CLID** <CellId>

Sets the Cell ID.

**Parameters:**

<CellId> integer

Range: 0 to 503
Increment: 1
*RST: 150

**Manual operation:** See "Cell ID" on page 288

---

**[:SOURce<hw>]:BB:EUTRa:TCW:WS:CYCPrefix** <CyclicPrefix>

Selects normal or extended cyclic prefix.

**Parameters:**

<CyclicPrefix> EXTended | NORMal

**Manual operation:** See "Cyclic Prefix" on page 288

---

**[:SOURce<hw>]:BB:EUTRa:TCW:WS:CQIPattern:PORT<ch0>** <CqiPattern>

In performance test cases, sets the CQI Pattern.

**Parameters:**

<CqiPattern> integer

**Example:**

```
SOURce1:BB:EUTRa:TCW:TC TS36141_TC839
SOURce1:BB:EUTRa:TCW:GS:TXANtennas ANT2
SOURce1:BB:EUTRa:TCW:WS:CQIPattern:PORT0 #H5,4
SOURce1:BB:EUTRa:TCW:WS:CQIPattern:PORT1 #H5,4
```

**Manual operation:** See "CQI Pattern Port 0/1 (bin)" on page 364

---

**[:SOURce<hw>]:BB:EUTRa:TCW:WS:DUPLex** <Duplex>

Selects whether TDD or FDD duplexing mode is used.

**Parameters:**

<Duplex> TDD | FDD

**Manual operation:** See "Duplexing" on page 288

---

**[:SOURce<hw>]:BB:EUTRa:TCW:WS:FMThroughput** <FractMaxThrough>

Selects the fraction of maximum throughput.

**Parameters:**

<FractMaxThrough> FMT70 | FMT30

**Manual operation:** See "Fraction of Max. Throughput" on page 332

---

**[:SOURce<hw>]:BB:EUTRa:TCW:WS:FRC** <FRC>

Queries the fixed reference channel used.

**Parameters:**

<FRC> A11 | A12 | A13 | A14 | A15 | A21 | A22 | A23 | A31 | A32 | A33 | A34 | A35 | A36 | A37 | A41 | A42 | A43 | A44 | A45 | A46 | A47 | A48 | A51 | A52 | A53 | A54 | A55 | A56 | A57 | A71 | A72 | A73 | A74 | A75 | A76 | A81 | A82 | A83 | A84 | A85 | A86 | UE11 | UE12 | UE21 | UE22 | UE3

**Manual operation:** See "FRC" on page 288

---

**[:SOURce<hw>]:BB:EUTRa:TCW:WS:FROffset** <FreqOffset>

Sets the frequency offset.

**Parameters:**

<FreqOffset> FO_1340 | FO_625 | FO_270 | FO_0

**Manual operation:** See "Frequency Offset" on page 367

---

**[:SOURce<hw>]:BB:EUTRa:TCW:WS:HSMode** <HighSpeedMode>

Enables/disables high speed mode.

**Parameters:**

<HighSpeedMode> 0 | 1 | OFF | ON

**Manual operation:** See "High Speed Mode" on page 367

---

**[:SOURce<hw>]:BB:EUTRa:TCW:WS:NTAOffset** <SigAdvNTAoffset>

Sets the parameter $N_{TAoffset}$.

**Parameters:**

<SigAdvNTAoffset> NTA624 | NTA0

**Manual operation:** See "Signal Advance N_TA_offset" on page 288

---

**[:SOURce<hw>]:BB:EUTRa:TCW:IS:ORTCover?**
**[:SOURce<hw>]:BB:EUTRa:TCW:IS2:ORTCover?**
**[:SOURce<hw>]:BB:EUTRa:TCW:IS3:ORTCover?**
**[:SOURce<hw>]:BB:EUTRa:TCW:WS:ORTCover[:PORT<ch0>]?**
**[:SOURce<hw>]:BB:EUTRa:TCW:WS:ORTCover?**

Queries the used resource index n_PUCCH.

**Return values:**
<OrthoCover> integer
Range: 2 to 2
Increment: 1
*RST: 2

**Usage:** Query only

**Manual operation:** See "Orthogonal Cover (n_PUCCH)" on page 353

---

**[:SOURce<hw>]:BB:EUTRa:TCW:WS:OUPLevel** <OutPowerLevel>

The settings of the selected test case becomes active only after selecting "Apply Settings".

**Parameters:**
<OutPowerLevel> float
Range: -115 to 0
Increment: 0.01
*RST: -30

**Manual operation:** See "Base Station Wanted Signal" on page 295

---

**[:SOURce<hw>]:BB:EUTRa:TCW:MUE:OVRB** <OffsetVRB>
**[:SOURce<hw>]:BB:EUTRa:TCW:SUE:OVRB** <OffsetVRB>
**[:SOURce<hw>]:BB:EUTRa:TCW:WS:OVRB** <OffsetVRB>

Sets the number of RB the allocated RB(s) are shifted with.

**Parameters:**
<OffsetVRB> integer
Range: 0 to 75
Increment: 1
*RST: 0

**Manual operation:** See "Offset VRB" on page 289

---

**[:SOURce<hw>]:BB:EUTRa:TCW:WS:PLevel?**

Queries the Power Level.

**Return values:**
<PowerLevel> string

**Usage:** Query only

**Manual operation:** See "Power Level" on page 289

---

**[:SOURce<hw>]:BB:EUTRa:TCW:WS:PLPC?**

Queries the resulting PUCCH power level by activated optional transmission of PUCCH format 2.

**Return values:**
<PowerLevelPUCCH>string

**Usage:** Query only

**Manual operation:** See "PUCCH Power Level" on page 344

---

**[:SOURce<hw>]:BB:EUTRa:TCW:WS:PLPS?**

Queries the resulting PUSCH power level.

**Return values:**
<PowerLevelPUSCH>string

**Usage:** Query only

**Manual operation:** See "Power Level (PUSCH)" on page 344

---

**[:SOURce<hw>]:BB:EUTRa:TCW:IS:PRCOndition?**
**[:SOURce<hw>]:BB:EUTRa:TCW:IS2:PRCOndition?**
**[:SOURce<hw>]:BB:EUTRa:TCW:IS3:PRCOndition?**
**[:SOURce<hw>]:BB:EUTRa:TCW:WS:PROCondition** <PropagationCond>

Selects a predefined multipath fading propagation conditions. The settings of the fading simulator are adjusted according to the corresponding channel model as defined in 3GPP TS 36.141, Annex B.

**Parameters:**
<PropagationCond> AWGNonly | HST3 | HST1 | PDMov | ETU200Mov | ETU300 | EVA70 | EVA5 | EPA5 | ETU70

**Manual operation:** See "Propagation Conditions" on page 329

---

**[:SOURce<hw>]:BB:EUTRa:TCW:WS:RFFRequency** <RfFrequency>

Sets the RF frequency of the wanted signal.

**Parameters:**
<RfFrequency> float

Range: 100e+03 to 6e+09
Increment: 1
*RST: 1.95e+09

**Manual operation:** See "RF Frequency" on page 287

---

**[:SOURce<hw>]:BB:EUTRa:TCW:WS:SPSFrame** <SpecSubframe>

In TDD duplexing mode, sets the Special Subframe Configuration number.

**Parameters:**
<SpecSubframe> integer
Range: 0 to 8
Increment: 1
*RST: 0

**Manual operation:** See "Configuration of Special Subframe" on page 367

---

**[:SOURce<hw>]:BB:EUTRa:TCW:WS:TDDConfig** <TddConfig>

For TDD mode, selects the UL/DL Configuration number.

**Parameters:**
<TddConfig> integer
Range: 0 to 6
Increment: 1
*RST: 0

**Manual operation:** See "TDD UL/DL Configuration" on page 288

---

**[:SOURce<hw>]:BB:EUTRa:TCW:WS:TIOBase?**

Queries the timing offset base value.

**Return values:**
<TimingOffsBase> float
Range: 0 to 250
Increment: 0.01
*RST: 0

**Usage:** Query only

**Manual operation:** See "Timing Offset Base Value" on page 367

---

**[:SOURce<hw>]:BB:EUTRa:TCW:MUE:UEID** <UE_ID_nRNTI>
**[:SOURce<hw>]:BB:EUTRa:TCW:SUE:UEID** <UE_ID_nRNTI>
**[:SOURce<hw>]:BB:EUTRa:TCW:WS:UEID** <UE_ID_nRNTI>

Sets the UE ID/n_RNTI.

**Parameters:**
<UE_ID_nRNTI> integer
Range: 0 to 65535
Increment: 1
*RST: 1

**Manual operation:** See "UE ID/n_RNTI" on page 288

# A References


- [1] 3GPP TR 25.913 "Requirements for Evolved UTRA (E-UTRA) and Evolved UTRAN (E-UTRAN)"
- [2] 3GPP TR 25.892 "Feasibility study for Orthogonal Frequency Division Multiplexing (OFDM) for UTRAN enhancement"
- [3] 3GPP TS 36.211 "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical Channels and Modulation"
- [4] 3GPP TS 36.212 "Evolved Universal Terrestrial Radio Access (E-UTRA); Multiplexing and channel coding"
- [5] 3GPP TS 36.213 "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures"
- [6] 3GPP TS 36.141 "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) conformance testing"
- [7] 3GPP TS 36.214 "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer; Measurements"
- [8] 3GPP TS 36.101 "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception"
- [9] 3GPP TS 36.104 "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) radio transmission and reception"
- [10] 3GPP TS 36.113 "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) and repeater ElectroMagnetic Compatibility (EMC)"
- [11] 3GPP TS 36.124 "Evolved Universal Terrestrial Radio Access (E-UTRA); ElectroMagnetic Compatibility (EMC) requirements for mobile terminals and ancillary equipment"
- [12] 3GPP TS 36.133 "Evolved Universal Terrestrial Radio Access (E-UTRA); Requirements for support of radio resource management"
- [13] 3GPP TS 36.143 "Evolved Universal Terrestrial Radio Access (E-UTRA); FDD repeater conformance testing"
- [14] 3GPP TS 36.521 "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) conformance specification; Radio transmission and reception; Part 1, 2, 3"
- [15] 3GPP TS 36.523 "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) conformance specification; Part 1, 2, 3"
- [16] 3GPP TS 36.331 "Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification"
- [17] Rohde&Schwarz, C. Gessner "Long Term Evolution. A concise introduction to LTE and its measurement requirements", ISBN 978-3-939837-11-4, First edition 2011
- [18] Rohde & Schwarz, Application Note 1MA169 "LTE-Advanced Technology Introduction"
- [19] Rohde & Schwarz, Application Note 1MA166 “LTE-Advanced Signals Generation and –Analysis”

- [20] 3GPP TR 36.912 V 9.1.0 "Technical Specification Group Radio Access Network; Feasibility study for further advancements for E-UTRA (LTE-Advanced), Release 9", December 2009

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